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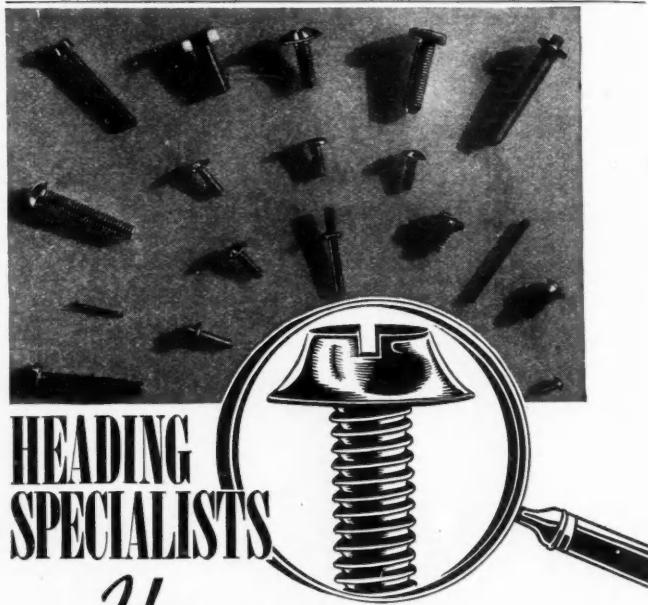
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PADS	WICKS	GASKOFELT
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HEADING SPECIALISTS

Users

of made-to-order screws and headed parts are daily discovering real economies in PROGRESSIVE cold upset products. They have found that many parts now made by screw machines can be uniformly headed with our modern equipment at substantial savings in dollars and time. It will pay you to consult our specialists about your fastening requirements.



The PROGRESSIVE MFG. CO.
TORRINGTON - CONNECTICUT

AUTOMOTIVE INDUSTRIES

AUTOMOBILE

Reg. U. S. Pat. Off.
Published Weekly

Volume 78

Number 5

JULIAN CHASE, Directing Editor
HERBERT HOSKING, Editor
P. M. HELDIT, Engineering Editor J. B. POLLOCK, Ass't Editor
JOS. GESCHELLIN, Detroit Technical Editor GEOFFREY GRIER, Art Editor
J. A. LAANSMA, Detroit News Editor MARCUS AINSWORTH, Statistician
JEROME H. FARRIS, Ass't Editor L. W. MOFFETT, Washington Editor
H. E. BLANK, JR. Ass't Editor JAMES G. ELLIS, Washington Editor

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C. A. MUSSelman, Pres.; J. S. HILDRETH, Vice-Pres. and Manager, Automotive Division; G. C. BUZBY, Vice-Pres.

OFFICES

Philadelphia—Chestnut & 58th Sts., Phone Sherwood 1424
New York—239 W. 39th St., Phone Pennsylvania 6-1100. Chicago—Room 916, London Guarantee & Accident Bldg., Phone Franklin 9494. Detroit—1015 Stephenson Bldg., Phone Madison 2990. Cleveland—609 Guardian Bldg., Phone Main 6860. Washington—1061 National Press Bldg., Phone District 6877. San Francisco—444 Market St., Room 305, Phone Garfield 6788. Long Beach, Cal.—1395 Pacific Ave., Phone Long Beach 613-238.

Cable Address: *Autoland*, Philadelphia

SUBSCRIPTION RATES: United States, United States Possessions, and all countries in the Postal Union, \$1.00 per year; Canada and Foreign, \$2.00 per year. Single Copies this issue, 25¢.

Member of the Audit Bureau of Circulations
Member Associated Business Papers, Inc.

Entered as second-class matter Oct. 1, 1925, at the post office at Philadelphia, Pa., under the Act of March 3, 1879.
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Owned and Published by



CHILTON COMPANY

(Incorporated)

Executive Offices
Chestnut and 56th Streets, Philadelphia, Pa., U. S. A.

Officers and Directors

C. A. MUSSelman, President
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January 29, 1938

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Automotive Industries

Production

No Increase in Output Rate Expected Until March

The automobile industry approaches the end of its first month this year with retail sales of new and used vehicles setting the pace for production in practically all plants and it is evident that this realistic attitude will be continued as February begins.

Although the fourth week of the current month will show a slight drop in production from the preceding two weeks there is a good chance that when final figures for January are computed they will show that total production for the month exceeded the preliminary estimate of 225,000 units by a fair margin.

With production schedules now strictly on a week to week basis few automotive men were willing to make a definite estimate for the next month although it is generally agreed that February probably will maintain the pace established this month with prospects of an increase in March from seasonal influences at least.

Sales reports beginning to come through for the second ten-day period in January are promising with several factories reporting improvement over the first period both in new and used car sales. Truck sales in a number of instances are showing improvement with the truck market appearing to be in a better condition than the passenger car field.

Used cars continue to be the problem child of the industry and no stone is being left unturned to get them moving in greater numbers. Prices of used cars have definitely reached the bargain stage and this condition is expected to influence the public's buying attitude favorably. Most factories report that their dealers have numbers of deals for new cars ready to close as soon as they are in a position to make trades for the owners' present cars.

Ford expected to continue its pace
(Turn to page 135, please)



Photo by Underwood and Underwood

"HEARTY AGREEMENT"

... with the President's principles on the subject of installment selling . . . " said Alvan Macauley, president of the Packard Motor Car Co. and head of the Automobile Manufacturers Association, pictured above as he emerged from the White House conference last week. (See article in this issue "Big Three" Heads Go To Washington" on page 135).

Labor

UAW to Press for New Contracts With GM and Chrysler

Renewal of existing contracts with Chrysler and General Motors, with the possibility of requests for "moderate" revisions, are expected to occupy the attention of officials of the United Automobile Workers unions during the next few weeks.

While the union's contract with General Motors has no expiration date, the corporation is reported to have consented to new negotiations for amending the present agreement as a result of the UAW international executive board's recent guarantee against "wildcat" strikes. The union is expected to suggest a date for the beginning of negotiations with the corporation within the next week.

Meanwhile, plans have been completed by the union to discuss proposals for a new contract with Chrysler to displace the present contract which expires on March 31.

(Turn to page 134, please)

Geiger Case Revived at Hearing

House Judiciary Committee Members Clash With Jackson Over Milwaukee Grand Jury Dismissal "Incident"

Because he had said the Department of Justice can enforce anti-trust laws only by the threat of criminal prosecution and the use of grand juries to obtain evidence, members of the House Judiciary Committee clashed with Assistant Attorney-General Robert H. Jackson Tuesday at hearings on Department of Justice charges against Judge Ferdinand A. Geiger for dismissing a Federal grand jury at Milwaukee after voting, but before reporting, a criminal indictment against automobile financing companies.

Jackson had been asked how the Department obtained information from a grand jury when its hearings are secret.

"Well, it's available to the Department," Jackson replied, adding that

it was easily learned who went before the jury.

Aroused by Jackson's remarks, Rep. Earl C. Michener, Republican of Michigan, said that it appeared that the "Department of Justice believes in an amplified third degree."

"No, sir," Jackson replied.

While questioning of Jackson proceeded, Committee Chairman Hatton W. Sumners, Democrat of Texas, interrupted to say:

"This appears to be a different proposition than that many members of the committee had thought." Mr. Sumners pointed out that when the hearings were announced with members of both the Wisconsin Bar and the Department of Justice invited, the committee had two sets of

(Turn to page 138, please)

Survey Industry's Promotion Outlay

Study Shows '37 Automotive Expenditures for Advertising Via Magazines, Radio, and Farm Papers Above '36 Totals

Automotive, including oil and gasoline, advertising expenditures during 1937 gained over the 1936 totals spent in magazines, the three leading radio networks, and farm papers, but showed a 6.9 per cent decline in newspaper lineage, according to an analysis by *Advertising Age*. (See "Automotive Advertising Leads," in the Jan. 22 issue of AUTOMOTIVE INDUSTRIES, page 94.)

General Motors Corp., however, led national advertisers in combined use of magazines, network radio, and farm papers with an aggregate expenditure of \$9,418,066 repeating its 1936 leadership. Chrysler stepped from fifth to fourth in expenditures in these media, with a total of \$4,717,479 in 1937 as compared with \$4,419,344 in 1936. Ford Motor Co. dropped out of the first 10 largest advertisers in these three media.

Leading the automotive group with the largest volume of radio advertising, General Motors stood ninth in a list of 105 largest spenders in this field. With its nine divisions plus institutional programs, General Motors spent \$1,818,291 in 1937 over the three networks, as compared with \$1,223,108 the year before. Other motor car companies followed in this order:

	1937	1936
Ford Motor Co. (11)...	\$1,768,285	\$2,082,664
Chrysler Corp. (20)...	911,051	617,578
Packard Motor Car Co. (26)	757,820	372,099
Nash Kelvinator Corp. (38)	534,273	89,790
Hudson Motor Car Co. (87)	147,690
Studebaker Corp. (95)	130,692	354,564

These seven motor car manufacturers spent a total of \$6,068,102 in 1937 on the three major radio networks, as compared with \$4,705,903 in 1936, a gain of about 22 per cent, or slightly more than the total gain of the 105 advertisers who spent more than \$100,000 on radio in 1937. The 105 companies spent \$64,749,835, of which the seven motor car builders spent about 10 per cent.

Eleven oil, gasoline, and automotive parts companies included among the companies spending more than \$100,000 on radio last year spent \$4,036,989, bringing the automotive total to \$10,105,091, or about one-sixth of the radio expenditures for the year. These companies were:

- Cities Service (33)
- * Sun Oil Co. (34)
- Texas Co. (35)
- Firestone Tire & Rubber Co. (36)
- Stewart-Warner Alemite (44)
- Gulf Refining Co. (52)

Shell Petroleum Corp. (61)
Atlantic Refining Co. (65)
Richfield Oil Co. (Calif.) (74)
Sinclair Oil Refining Co. (85)
Phillips Petroleum Co. (92)

Chrysler Corp. followed General Motors in farm paper advertising, holding the fifth place in a list of 50 advertisers in that medium for 1937,

in spite of reducing its expenditure from \$445,896 in 1936 to \$410,438 in 1937. General Motors showed an increase in farm papers from \$426,822 in 1936 to \$599,209 last year. Ford showed a slight loss in 1937 farm paper advertising as compared with 1936, but held third place among car manufacturers and ninth place in the whole list of 50 leading advertisers in this field. International Harvester Co. held third place, its truck advertising placing a large part in its program. I. H. C.'s 1937

Motor Vehicle Administrators

In a paper presented at the recent annual meeting in Detroit of the Society of Automotive Engineers, Charles A. Harnett, commissioner of motor vehicles for the State of New York, discussed the views of the majority of the members of the American Association of Motor Vehicle Administrators as to their approval or dislike of many features in the design of modern cars.

The thoughts of the administrators of 40 States, the District of Columbia and the Province of Ontario were revealed in answers to questions pertaining to desirable and undesirable features of present-day automobiles. "Their statements," said Mr. Harnett, "are based upon

their own personal experience and observation. They are not the findings of technical experts based upon exhaustive tests. They represent, however, the views of men actively engaged in the motor vehicle safety field; men who daily come in contact with the driving experience of thousands, in some cases millions, of motorists under their observation.

Listed below are the questions asked the administrators, together with a numerical tabulation of their replies. In instances wherein the replies included additional statements of importance, or when Mr. Harnett's remarks were especially pertinent, the numerical listing has been supplemented by notes.

Administrators Were Asked

	They Replied	
	Yes	No
1. Is present brake performance satisfactory?	34	8
2. The preferred type of brake is—(1)		
Hydraulic	38	..
Mechanical	2	..
3. Do you approve present brake pedal pressure for the average male driver?	38	1
4. Should present brake pedal pressure be made lighter for women drivers?	13	20
5. Are modern type brakes sufficiently well protected from dirt and water?	24	13
6. Do you consider booster brakes necessary or desirable for passenger cars?	8	28
7. Are present day provisions for brake adjustment satisfactory?	27	13
8. Where should the handbrake be located—(3)		
Under dash in center?	17	..
Under dash at left?	17	..
Center floor position?	8	..
Floor at left?	3	..
9. Are present day headlights satisfactory?	7	33
10. The most desirable number of headlight beam positions is—		
Two?	18	..
Three? (4)	20	..
11. Does present passing beam reduce glare sufficiently?	17	24
12. The bulb candlepower you recommend is—		
32 c.p.	23	..
30 plus c.p.	2	..
21 c.p.	2	..
22 c.p.	1	..
50 c.p.	1	..
13. Maximum beam candlepower permitted by your state is—		
75,000	5	..
50,000	3	..
No specific requirement	8	..
14. Are the present means for headlight adjustment satisfactory?	22	18
15. Do you favor auxiliary fender lamps?	16	23
16. Do you approve of fog lamps?	25	14
17. Do you favor mounting of tail light—(5)		
High?	27	..
Low?	13	..
18. What type stop light do you prefer? (6)		
Blinking	18	..
Steady dual	22	..
Steady single	4	..
19. Do you believe present steering mechanism sufficiently absorbs road shocks to permit maximum control of vehicle?	92	8
20. Does present steering mechanism have satisfactory means of adjustment?	29	3
21. Does knee action contribute to safety, roadability and ease of handling?	17	18
22. Does knee action increase sidesway in rounding curves?	22	13

total was \$539,190, as compared with an expenditure of \$824,957 in 1936.

NIAA Session Set for Cleveland

The National Industrial Advertisers Association will hold its sixteenth annual conference in Cleveland, Sept. 21-23, 1938, according to Stanley Knisely, advertising manager of Republic Steel Corp., who, as vice-president of the association, heads its committee for conference program and arrangements.

Tire Makers Urge Easing of Tax

Seek Relief from \$40,000,000 Annual Excise Burden With RMA Request for Concessions in New Bill

Tire manufacturers have launched a vigorous drive to obtain relief from their 40-million dollar annual excise tax burden and through the medium of the Rubber Manufacturers Association, have asked special concessions in the new tax bill now before the House Ways and Means

Committee. Since the excise tax on tires and tubes was imposed in July, 1932, the industry has paid the government nearly \$200,000,000 in such taxes. For the first three quarters of 1937 the tax on tires totaled \$30,837,400 and on tubes \$6,404,000. Total amount collected in 1937 is estimated to have exceeded \$40,800,000. The estimate for 1938 is \$40,500,000.

The present levy is 2½ cents per pound on the weight of tires and 4 cents per pound on the weight of inner tubes.

The present levies on tires and tubes, the producers contend, are completely out of harmony with the tax rate for other commodities in the excise group, including even the luxury items.

The manufacturers are not asking for complete removal of the tax but only for a "substantial" reduction.

One suggestion placed formally before the committee would reduce the levy to 2 per cent of the wholesale value, which would mean roughly a 30 million dollar cut in the return.

Except for gasoline, tobacco, liquor, and motor vehicles—the "big four" revenue raisers—tire taxes contributed the largest amounts of any items in the excise group. Liquor last year brought in \$593,831,000, tobacco \$551,923,000, gasoline \$193,533,000, and automobiles, trucks and motorcycles \$84,364,000.

The tiremakers are comparing their own assessments with those of other lines—lubricating oils, \$31,463,000, electrical energy, \$35,975,000, automobile parts and accessories \$10,086,000, telephone and telegraph messages \$24,570,000, admissions and club dues \$26,028,000.

"In cases where the excise tax is set on a percentage basis, it is not above 10 per cent in any case and the 10 per cent is limited for the most part to luxury items, on several of which the subcommittee has recommended repeal of the tax," according to the Association.

Chrysler to Open New Plant

Chrysler Corp. of Canada, Ltd., has announced that production will begin soon in its new \$3,000,000 engine manufacturing plant at Windsor, Ont.

The factory will turn out six-cylinder powerplants for Chrysler, Plymouth, Dodge and DeSoto passenger cars and for Dodge and Fargo trucks and commercial vehicles.

Give Views on Car Design

Administrators Were Asked

	They Replied	
	Yes	No
23. Do you prefer the linked parallelogram type of knee action? Or— Have you no choice?	14	..
24. As to speed, does the modern car have— Too much?	9	..
Sufficient?	27	..
Insufficient?	14	..
25. Do you approve the use of speed governors? (General Question) (7). For trucks and buses only?	12	23
For convicted speeders?	2	..
26. Do you believe a dripbead to carry off rain and melted snow to be a desirable feature? (8)	1	..
27. Do you favor the elimination of running boards?	37	3
28. Do you believe more headroom should be added to prevent passengers striking heads when entering cars from high curbs?	8	29
29. Do you favor recessing of choke, throttle, light switches and ash re- ceivers?	19	21
30. Do you favor recessing of robe rail hardware to eliminate injury re- sulting from sudden stops?	34	..
31. Is present driver's seat too low to permit adequate visibility?	37	3
32. Should driver's seat be adjustable for height, as well as forward and backward?	19	17
33. Is present car hood to high? (9)	38	2
34. Do divided windshields materially obstruct vision?	26	16
35. Do divided rear windows materially restrict vision? (10)	23	19
36. Should dual windshield wipers be standard equipment?	20	21
37. Should windshield wipers be equipped to permit manual operation?	41	..
38. Where should windshield wipers be mounted— Top of windshield?	28	11
Bottom of windshield?	16	..
39. Do you believe vacuum boosters desirable to insure constant speed of windshield wiper?	23	..
40. Should some form of defrosting device be included as standard equip- ment as a safety measure?	34	7
41. Do corner posts obscure vision unduly?	41	1
42. Is simplified control through automatic or semi-automatic transmission desirable from a safety standpoint	24	15
43. Should safety glass be used in all windows of cars?	12	18
44. Should anti-roll-back devices, for starting on steep hills, be featured as standard equipment?	41	1
45. Are present bumpers sufficiently strong? (11)	23	7
46. Are car radios distracting to the driver? (12)	27	13
47. Do you approve of the fish pole type aerial? (13)	14	21
48. The position you favor for rear license plates is— Center? (14)	5	29
Left?	25	..
	16	..

NOTES

(1) Others, including Mr. Harnett, stated they had no preference and believed that selection of the best brake lies solely with the automotive engineers. (2) Commissioner Harnett believes they would be desirable on heavy passenger cars. (3) Mr. Harnett contends the handbrake should be placed to the right of the driver, either on floor or under dash. This to enable passenger accompanying operator to reach brake in cases of emergency. (4) Mr. Harnett stated, "While I believe the three beam position is technically a good feature, I doubt whether the average motorist will use a third beam. Some difficulty has been found in getting him to use satisfactorily the two beam lights." (5) A medium height of 32 in. was expressed by Mr. Harnett as being most satisfactory. (6) Of the administrators favoring blinking stop lights, eight specified dual, one specified single. In referring to the blinking lights, Mr. Harnett said, "They are unnecessary and, if universally used, may turn out to be an added burden which the eyes of the operator will have to bear at night." (7) Of the administrators who favored the use of governors, seven suggested they be set at 50 m.p.h., five suggested 60 m.p.h., and one suggested 55 m.p.h. (8) One commissioner felt that such a device should be extended to include the windshield. (9) Mr. Harnett stated, "We firmly believe the present frontal structure should be lowered. For an even greater degree of safety and visibility, we would go so far as to recommend that engines be installed in the rear of the car." (10) Said Mr. Harnett, "Demanding particular attention is the rear window which is rapidly disappearing. We believe that small rear windows are proving most unsatisfactory and that they should be enlarged." (11) One commissioner recommended bumpers be made uniform in height. (12) Records in New York State, according to Mr. Harnett, fail to give any evidence against radios as a cause of accidents. (13) Four of the five administrators who approved the fish pole aerial were from western states. (14) Mr. Harnett favored a 32 in. height for good visibility.

Labor

(Continued from page 131)

A delegate conference to be attended by 83 delegates representing all Chrysler locals opens in Detroit on Jan. 29.

The union has announced that it will ask for a revision of the present clause in its Chrysler contract which prohibits any strikes during the life of the contract "not because it is opposed to a ban on unauthorized strikes, but because we want some further procedure agreed upon so we can arbitrate on matters in dispute," according to R. J. Thomas, UAW vice-president in charge of Chrysler.

"Organized labor, like big industry, must make cuts when its revenues are reduced," said Homer Martin, UAW president, at a press conference in which he confirmed reports that there would be a further reduction in the union's staff of organizers as well as in the office staff. He denied reports that organizers were being cut from 100 to 35, saying that the present Ford staff of 40 organizers would be maintained at full strength. No decision has yet been made in number to be affected by the latest reduction, he said.

MEN OF THE INDUSTRY



ADOLF BABIACKI has joined, as a partner, the firm of Joachim Gerson, I Ska, Poland.

VICTOR J. HENRY has been appointed as service manager for the American Bantam Car Co., Butler, Pa., with headquarters at the home office. Mr. Henry has been identified with automotive factory sales and service for the past eighteen years.

P. NORMAN BERRY, head office executive of General Motors Products of Canada, Ltd., Oshawa, Ont., has been named manager of the Montreal zone to succeed the late **C. D. GLEASON**. Mr. Berry's post at Oshawa has been filled by the appointment of **A. D. CREWS**, formerly Toronto, zone retail selling manager.



REP. GARDNER R. WITHROW

Congressman from Wisconsin who was interviewed this week by the Editor of *Automotive Industries*. (See article below "Withrow Wants a Law.")

Withrow Wants a Law

Sees Federal Legislation on Factory-Dealer Contract Essential to Solution of Grievances

Federal legislative control of contract relations between automobile manufacturers and their dealers is viewed as an eventual necessity by Representative Gardner R. Withrow of Wisconsin, sponsor in Congress of the resolution which has already given a quasi-public airing to the dealer factory question.

The factory-dealer contract, because of its cancellation clause, is the focal point of all factory-dealer relations questions, the Congressman declared emphatically in an interview with the editor of *Automotive Industries*. Enlarging on his belief that State fair-trade-practice laws do not provide an adequate remedy for dealer grievances on such phases of manufacturers' activity as are in interstate commerce, Congressman Withrow reasons that the dealer contract is the manufacturer's link with interstate commerce and is, therefore, particularly amenable to Federal control.

Reminded that the National Automobile Dealers Association has recorded its support of an investigation, without asking for specific remedies, he expressed the opinion that such a remedy could be found "in some kind" of a Federal statute governing contracts between factories and dealers. He declared his willingness to sponsor such legislation in Congress.

Representative Withrow believes it reasonable to expect that his revised resolution will pass the present session of Congress.

Sub-Committee Sanctions Approval

A sub-committee of the House Interstate and Foreign Commerce Committee has recommended to the full committee that the Withrow resolution providing for an FTC investigation of manufacturer-dealer relations in the automobile industry be approved and broadened to cover



A.S.T.E. OFFICERS Members Floyd Eaton of Burroughs Adding Machine. The executive committee of the Detroit Chapter, American Society of Tool Engineers talk over plans for the National A.S.T.E. Machine, Tool and Equipment Show to be held at Convention Hall, Detroit, March 9.

Left to right are Treasurer George Demarest of Packard, Chairman Charles Staples of Giern-Anholt Tool Co., and

monopolistic practices and any other anti-trust law violations.

The amendments to the Withrow resolution were suggested by a member of the Federal Trade Commission's legal staff, who told the subcommittee that the \$50,000 appropriation called for in the resolution would be adequate to cover the broader investigation.

The FTC would be directed to report its findings to Congress within one year with recommendations for remedial legislation if found warranted.

There is a growing belief in some Washington quarters that the resolution will be reported favorably by the House committee and that it will be given House approval. The Minton resolution, similar in scope, has already been approved by the Senate Interstate Commerce Committee but it does not empower FTC to scrutinize possible anti-trust violations.

Production

(Continued from page 131)

of about 4000 units a day for five days this week, most of the General Motors' units operated on the three-day basis established at the first of the year, Chrysler units completed two full days, and Hudson put in a full five-day week devoted largely to its new low priced unit.—J.A.L.

New Auto-Lite Advertising Agent

Electric Auto-Lite Co., Toledo, has appointed Ruthrauff & Ryan, Inc., to handle advertising of the new line of spark plugs, and service and institutional copy.

... slants

BEHIND THE SCENES—Importance of the automobile industry as a customer for other industries is indicated by the fact that parts and materials used in making a steering gear some times pass through as many as 15 different types of industrial establishments before reaching the assembly line.

The Automobile Manufacturing Association lists the following industries participating in some phase of the production of automobile steering gears: steel mills, tube mills, bearing makers, iron foundries, drop forging plants, die-casting plants, zinc smelting plants, plating works, paint and enamel works, brass plants, screw machine parts factories, manufacturers of lubricants, plastic manufacturers, plastic molders and gear manufacturers.



CONFERENCE

... with President Roosevelt last week brought executives of the automobile industry to Washington.

Conferees, left to right: K. T. Keller, president, Chrysler Corp.; Ernest Kanzler, president, Universal Credit Corp.; Edsel Ford, president, Ford Motor Co.; John J. Shuman, president, General Motors Acceptance Corp.; Senator Prentiss Brown, of Michigan; B. E. Hutchinson, chairman finance committee, Chrysler Corp.; William S. Knudsen, president, General Motors Corp.; Henry Ittelson, president, Commercial Investment Trust; and A. D. Duncan, president, Commercial Credit Co.

At the right, K. T. Keller and W. S. Knudsen, pictured as they left the White House.



Photos by Underwood & Underwood

“Big Three” Heads Go to Washington

*Automobile Industry Executives Discuss Installment Buying
In White House Conference with President Roosevelt*

Representatives of the automobile industry announced last week, following a 90-minute conference with President Roosevelt, that they are in accord with the Chief Executive's principles covering installment buying. They agreed to report back to the President any improvement in the situation, although no time was set for a further meeting.

“Properly used, installment buying has and will continue to help millions of families to a higher standard of living with a corresponding increase in employment,” said Alvin Macauley, president of the Automobile Manufacturers Association, and of the Packard Motor Co., who acted as spokesman for the group following the conference. “But high pressuring customers or permitting their desires to take them into debt beyond their means is bad business all around.”

The President, it is understood, did not ask the motor executives to subscribe to any specific plan, but merely pointed out that he was disturbed by what has been described as unreasonably long-term finance paper, a factor which has been re-

ported to be an equally disturbing one to the industry. The automobile industry spokesmen agreed to look into the situation further.

Mr. Roosevelt has been critical of automobile financing policies on several occasions since his message to Congress early in January, during which he referred to “high-pressure salesmanship” as one cause of cycles of overproduction and resultant periods of little or no production. He subsequently elaborated on these remarks in terms of the automobile industry and raised the point that over-selling the market through too liberal credit terms and high-pressure selling was bad practice. He has been represented as favoring a tightening of terms by abandoning the 24-month payment plan and by encouraging buyers to limit their automobile debt to about 25 per cent of their annual income.

At the White House conference, it is understood that the conferees told Mr. Roosevelt they realized the necessity of instituting more conservative financing methods, but not to the point where sales would be im-

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Business in Brief

Written by the Guaranty Trust Co., New York

A moderate gain in general business activity occurred during the week ended Jan. 15, but the gain was not sufficient to warrant the belief that it marks a reversal of the trend. The weekly index compiled by the *Journal of Commerce* for that period stood at 69.8, as compared with 67.4 the week before and 96.4 for the corresponding period last year. Retail trade was stimulated by the colder weather, and the volume ranged from 1 to 4 per cent above that in the preceding week and from 2 to 8 per cent above that recorded a year ago.

Railway freight loadings during the week ended Jan. 15 totaled 580,600 cars, which marks a gain of 28,286 cars above those in the preceding week and a decrease of 115,435 cars below those a year ago.

Production of electricity by the electric light and power industry in the United States during the week ended Jan. 15 was 6.6 per cent below that in the corresponding period last year. Production during the preceding week was 4.7 per cent below that a year ago.

Construction contracts awarded during December in 37 eastern

states, according to the F. W. Dodge Corp., amounted to \$209,450,600, as compared with \$199,695,700 in the corresponding period last year. Contracts awarded for the full year 1937 amounted to \$2,913,060,000, the highest in six years, marking an increase of 9 per cent above those in 1936. All classes of construction shared in the increase excepting public works. Residential building registered a gain of 13 per cent.

Average daily crude oil production for the week ended Jan. 15 amounted to 3,476,900 barrels, as compared with 3,437,100 barrels the week before and 3,184,650 barrels for a year ago.

Professor Fisher's index of wholesale commodity prices for the week ended Jan. 22 stood at 83.4, as compared with 83.9 the week before and 83.2 two weeks before.

The consolidated statement of the Federal Reserve banks for the week ended Jan. 19 showed no changes in holdings of discounted bills, bills bought in the open market, and Government securities. Money in circulation declined \$49,000,000, and the monetary gold stock remained unchanged.

1937's Output Total Placed at 5,016,565 Units

Surpassing the industry's 5,000,000 goal by 16,565 units, total passenger car and truck production in the United States and Canada during 1937 showed its heels to the 1936 figure by about 8.7 per cent.

December's grand total lagged approximately 8 per cent as compared with November's, and fell short of the 518,958 units turned out in the last month of 1936 by 172,072 units, or roughly 50 per cent.

Total truck production, however, showed a gain in December of slightly more than 30 per cent as compared with the truck output totals for the preceding month, and led the 1936 total of 77,636 by the comfortable margin of about 13.5 per cent.

Passenger Car and Truck Production

(U. S. and Canada)

	December 1937	November 1937	December 1936	Twelve Months	
				1937	1936
Passenger Cars—U. S. and Canada					
Domestic Market—U. S.	212,655	269,580	398,502	3,643,380	3,458,051
Foreign Market—U. S.	31,730	25,748	26,773	272,483	211,477
Canada	14,384	13,793	15,957	152,631	128,369
Total	258,769	309,121	441,322	4,068,494	3,797,897
Trucks—U. S. and Canada					
Domestic Market—U. S.	52,215	48,969	60,063	690,264	649,997
Foreign Market—U. S.	29,634	15,758	13,282	203,438	134,590
Canada	6,268	2,781	4,291	54,369	33,790
Total	88,117	67,508	77,636	948,071	818,377
Total—Domestic Market—U. S.	264,870	318,549	458,655	4,333,644	4,108,048
Total—Foreign Market—U. S.	61,364	41,506	40,055	475,921	346,067
Total—Canada	20,652	16,574	20,248	207,000	162,159
Total—Cars and Trucks—U. S. and Canada	346,886	376,829	518,958	5,018,565	4,616,274

See Rubber Prices Firm

Exportable Allowance for 2nd Quarter Cut By Committee

Crude rubber prices probably will be strengthened considerably as result of the action Jan. 25 of the International Rubber Regulations Committee of London in cutting from 70 per cent to 60 per cent the exportable allowance of rubber for the 2nd quarter of 1938. Only once before under British Restriction—and that several years ago—has the restriction on rubber been as low as 60 per cent.

The committee's action is interpreted in the United States as a determined effort to force crude rubber up to an 18 cent price level, which is generally regarded as economically fair. When the committee last fall made a drastic 22 per cent cut in the exportable allowance, reducing it from 90 per cent to 70 per cent effective with the start of the new year, it was expected that crude prices would show substantial strength. While they did recover from the 14 cent bottom reached in mid-November, they never exceeded 15½ cents and have since that time sagged back to less than 15 cents per pound.

The course of rubber prices will be governed principally by consumption in the United States, and domestic crude consumption in turn will depend upon the rate of new car production.

The cut from 70 per cent to 60 per cent will reduce the exportable quota from 260,000 long tons for the first quarter to 227,000 tons for the second quarter. The releases in the fourth quarter of 1937 on the 90 per cent basis were more than 315,000 tons.

Manufacturers who are heavily stocked with higher priced rubber will welcome the committee's action and a strengthening of crude prices, for higher crude prices will tend to stabilize tire prices and avert any necessity for price reductions.

Tuthill Enters Metallizing Field

The Tuthill Spring Co., Chicago, recently announced its entrance into the metallizing field by the addition of a completely equipped metallizing division.

Metallizing, the process of spraying molten metal on to any solid object, has been found to be useful in building up worn parts such as shafts, cylinders, rolls, bearing journals, patterns, castings, etc.

It is used also in building corro-

sion resisting surfaces on tanks, boilers, etc. Another of its many uses is the preservation and decoration of non-metallic objects.

Washington Conference

(Continued from page 135)

paired. Manufacturers have already taken steps in that direction, he was told, and have made progress.

"We had a broad discussion of the factors affecting business and government and we believe it was very helpful," Macauley said in a statement read to the press.

"We reported to the President that we are hopeful of a seasonal increase of sales in the spring that will bring about an improvement in business.

"We found ourselves in hearty agreement with the President's principles on the subject of installment selling....

"We agreed to meet and discuss among ourselves any possible improvement relating to the subjects discussed and to report back to the President."

Macauley said all the conferees concurred in the statement. They included:

K. T. Keller, president, and B. E. Hutchinson, finance committee chairman, Chrysler Motor Corp.; Edsel Ford, president, Ford Motor Corp.; John J. Schumann, Jr., General Motors Acceptance Corp.; A. E. Duncan, president, Commercial Credit Co.; Ernest Kanzler, president, Universal Credit Corp.; Henry Ittelson, president, Commercial Investment Trust, and W. S. Knudsen, president, General Motors Corp.

40 Years Ago

with the ancestors of
AUTOMOTIVE INDUSTRIES

Diesel Vehicle Motors

A company, called the Diesel Motor Co. of America, has been organized under the presidency of Adolphus Busch, the well-known brewer of St. Louis. The policy of the company will be, not to manufacture motors themselves, but to sell rights to proper parties having the necessary plants to take up the manufacture of the motor for the many purposes to which it may be adapted.

Colonel E. D. Meier, engineer-in-chief, states that one of the first branches to be taken up will be the vehicle motor.

From *The Horseless Age*, April, 1898.

SAFETY—

Professor John M. Lessells (left), of the Massachusetts Institute of Technology, illustrates "the hazard zone of motoring"—the danger of skidding on wet pavement—to Dr. Miller McClintock, director of the Harvard University Bureau of Street Traffic Research, following a broadcast on traffic safety. The broadcast was one of a series sponsored by the Elks, and given under the auspices of the Automotive Safety Foundation. Predictions of science serving as the ally of safety as voiced by Professor Lessells and Dr. McClintock appear below in the article "See Traffic Safety Via Science."



See Traffic Safety Via Science

*McClintock and Lessells Broadcast Their Prognostications
Of Five Major Motoring Transformations*

Science will be an ally of safety, and automobiles will be steered by unseen hands, wipers under cars will remove the dangers of skidding, roadway lighting will be controlled by "invisible eyes," and short-wave radio warnings will prevent collisions. This was predicted Jan. 24 by Dr. Miller McClintock, director of the Bureau of Street Traffic Research at Harvard University and Professor John M. Lessells, of Massachusetts Institute of Technology. They spoke on an N.B.C. national broadcast hookup under the auspices of the Automotive Safety Foundation.

The broadcast was conducted by Major Charles Spencer Hart, Grand Exalted Ruler of the Benevolent and Protective Order of Elks, and was one of a series in the nation-wide Elks Traffic Safety program, initiated by Major Hart in 1400 cities where Elk Lodges are located, and where the 500,000 members are conducting a vigorous campaign to eliminate ticket-fixing and at least one traffic hazard in each community.

Peering into the scientific future, Dr. McClintock and Professor Lessells predicted five major motoring transformations:

1. Steering by unseen hands, operated by short-wave radio, to take control of a car rounding curves and heading for obstructions.

2. Elimination of skidding on wet roads by application of scientific as-

surance of a dry paving surface for tires to hold.

3. Use of photo-electric cells and infra-red lights to prevent an automobile from coming too close to the car ahead.

4. Two-way automatic radios in all cars to give warning of other cars approaching at highway intersections.

5. Automatic highway illumination, operated by photo-electric cells, to flood with increased light only that portion of the highway actually used by a moving auto.

"Electric cables would be buried in the paving, with radiations related to control mechanisms within vehicles so that at such locations, as, for example, upon curves or around obstructions, where these cables would be laid, the steering of the vehicle would be automatically taken from the driver and the car centered and steered over the cable," Dr. McClintock said.

"Photo-electric cells could be employed in connection with infra-red lights to operate mechanisms which would reduce speed when a car approached within a given distance of a car ahead. Photo-electric cells could also be used to turn on more powerful highway lights just ahead of a moving car," he explained, and added "that it is possible to develop two-way radio to operate a warning light or sound signal in a car when

(Turn to page 156, please)

Automotive Metal Markets

Additional Steel-Making Furnaces Started Up in Detroit Area As Specifications Received by Finishing Mills Increase

Improvement in steel demand made further headway this week. As especially encouraging developments were pointed out the placing in operation of additional steel-making furnaces in the Detroit area and the uptrend in the number of specifications coming to finishing mills, denoting return to the market of consumers who for some time had been eking out their requirements from reserve stocks. None of the individual commitments, however, is thought to have entailed more than moderate routine tonnages.

Some automobile manufacturers, while willing to verify reports of their having placed orders, are apparently reluctant to name tonnages, which might lead to misinterpretation of their production programs. Parts makers still have considerable stocks of strip steel on hand, but somewhat broader inquiry and a larger number of releases are noted by Middle West steel bar mills. Sheet mills, for the most part, are approaching the point where from-day-to-day orders received by them balance outgoing shipments. This week's rate of employed ingot capacity, 32.7 per cent, denotes an increase of 9.7 per cent over the preceding week.

The subject of steel prices continues to come in for more airing in Washington than in the steel market. Veteran steel purchasing agents look upon pressing for lower prices as useless when demand is subnormal, as it is now, as when it is abnormally high. Neither condition makes for a responsive state of mind on the part of sellers. When the momentum of demand has reached a point where price concessions might stimulate buying, so that increased volume of output makes up for them, astute purchasers usually shape their policies so as to drive this home to sellers.

The steel industry has time and again given proof of its ability to recuperate over night, so to speak, following a long siege of illness. Orderly progress in this direction is looked upon as holding out more of a promise of price adjustments than pressure from Washington. One of the Washington newspaper correspondents said this week that "according to confidential reports received in Washington, one independent steel company is selling to 'good customers' at \$10 a ton below

the official market price." The story was characterized in the steel market as highly improbable, if not impossible under the present sales methods of steel producers.

Copper is in so much better supply than demand that the market continues easy. Custom smelters adhered to their policy of adjusting their price daily to the consuming demand, offering metal at 10½ cents on the first two days of the week. Business booked by them was light. Large mine producers continue to quote 10½ cents, with their business as restricted to bookkeeping transactions with their own fabricating subsidiaries as when they quoted 11 cents. Prices for copper and brass products, however, have been revised on the 10½-cent basis for the metal. Foreign demand, heretofore frequently a prop for domestic prices, has slumped off. London cables ascribe a drop of \$5 a ton there on Monday to natural reaction, following too rapid advances and to realization that world stocks of refined copper have risen to 60,000 tons.

Demand for tin was disappointing, even when the price early this week for spot Straits receded to below 41 cents. Later the market showed a shade more buoyancy and spot Straits recovered to 41 cents, with futures fractionally higher. Not so many weeks ago, it was thought that tin at around prevailing price levels would attract much consumer buying, but interest appears to be lagging for the present.

Lead and zinc are marking time, but output of both metals is being brought more into line with apparent demand.—W.C.H.

Geiger Case Revived

(Continued from page 131)

charges brought to its attention.

This clear indication of committee disapproval of Attorney-General Homer S. Cummings for bringing the charges against Judge Geiger was reflected in the critical attitude frequently taken by the committee during the proceeding.

Jackson declared that the Department of Justice was not requesting the impeachment of Judge Geiger, but only the judgment of the committee whether the Department should be prohibited from conducting

negotiations looking toward a consent decree while criminal charges were being shaped.

Jackson's remarks about using grand juries to obtain evidence, which set off the fireworks, both at the hands of the committee and Benjamin Poss, president of the Wisconsin Bar Association, which rallied to Judge Geiger's defense, were associated with his declaration that the Department has no power of subpoena. He suggested an amendment to the Sherman anti-trust law to provide for "discovery proceedings."

Mr. Poss asserted that Russell Hardy, special assistant Attorney-General in charge of the Milwaukee case, should and could have obtained an indictment despite Judge Geiger's dismissal of the jury. Hardy said that he would have been punished for contempt of court if he had the jury report an indictment, Jackson replied.

Mr. Jackson's statement of the Department's position came on the heels of his request that "independent" automobile financing representatives be permitted to appear before the committee.

After explaining at some length how the Government proceeded to bring about consent decrees with large corporations to end alleged violations, Jackson charged that Judge Geiger dismissed a greater percentage of indictments than any other Federal judge.

Autopulse Ups Pump Capacity

An improved Autopulse electric fuel pump capable of delivering a free flow of 18 gal. per hr. rather than the 14 gal. per hr. delivered by the current standard model is now on test in several passenger-car plants. The new pump requires one amp. instead of two, is equipped with a water catch in the filter bowl, and weighs the same as the three-pound current model.

Report Results of Economy Run

A report of results in the Gilmore Yosemite Economy Run, Jan. 13, will be published in AUTOMOTIVE INDUSTRIES, Feb. 5.

Cars were classified as follows: A. four cylinder cars; B. under \$930; C. \$931-\$1,130; D. \$1,131-\$1,175; E. \$1,176-\$1,260; F. \$1,261-\$1,400; G. \$1,401-\$1,500; H. \$1,501-\$1,600; I. \$1,601-\$1,960; J. over \$2,000.

First in each class were: A. Willys; B. Ford "60"; C. Hudson Terraplane; D. Pontiac; E. Studebaker; F. Nash; G. Hudson; H. Graham; I. Lincoln-Zephyr; J. Packard.

Nash Export Sales to Detroit

Transfer of the Export Sales Department of the Nash Motors Division of Nash-Kelvinator Corp. from Kenosha, Wis., to Detroit, was announced this week by C. H. Bliss, vice-president and director of sales of the division.

Executives of the department who are affected by the move and who henceforth will maintain their headquarters in Detroit are H. M. Salisbury, export sales manager, and J. L. Todd, assistant export sales manager.

Mexican Tariffs Raised

Increase Of 200% On Automobiles Under New Classification

Increases of 200 per cent or more are made on certain types of automobiles under the new classification of the Mexican tariff.

The new and former duties, stated in pesos for each automobile or truck, are as follows (a peso equals 27.8 cents):

Passenger automobiles of all kinds, up to 4 cylinders, for any number of passengers, not specified, 300 (180); passenger automobiles of all kinds, of more than 4 and up to 6 cylinders, with a capacity up to 6 passengers, not specified, 700 (200); the same, with capacity of more than 6 and up to 9 passengers 700 (300); passenger automobiles of all kinds, of more than 6 and up to 8 cylinders, with a capacity up to 6 passengers, not specified, 700 (300); the same, with a capacity of more than 6 and up to 9 passengers, 700 (500); passenger automobiles of all kinds, of more than 8 cylinders, for any number of passengers, 2500 (1000); automotive trucks of all kinds of more than 4 cylinders, with the same, with enclosed body, is not specified, 350 (150); stake body, with or without cab, 350 (150); tank trucks of all kinds for the transport of liquids, 350 (150).

The new duties are to be operative until April 30, 1938, after which they are to be decreased, but to a level generally in advance of the duties which had prevailed heretofore.

Navy Contract to Chance-Vought

A \$3,525,694 contract for the construction of 58 scout bombing planes has been awarded by the Navy Department to the Chance-Vought Division of the United Aircraft Corp., East Hartford, Conn.



Hydraulic Press

... self-contained, individually powered unit for forming, blanking and drawing of metal

Farrell-Birmingham Co., Inc., Ansonia, Conn., has brought out a new press of the self-contained, individually-powered type, with the motor-driven pump mounted on top of the press.

The capacity of the press may be varied between 50 and 300 tons. The press has one 18 in. main ram and two double-acting rams, mounted in the top crosshead. The maximum working pressure is 2500 lb. per sq. in. supplied by a radial piston pump driven by a 20 h.p. motor. Speed of the down stroke is 241 in. per min., the return traverse 321 in. per min., and the pressing speed 12.7 in. per min. Maximum opening of the press is 44 in. and the maximum stroke, 18 in.

Crossheads and frames between the top and bottom crossheads are

made of Meehanite metal, a high strength, high tensile alloy iron. Tie rods are steel. The main cylinder is bronze lined. The moving crosshead is equipped with an adjustable knock-out. Adjustment of the moving crosshead guides is facilitated by adjustable bronze gibs sliding against the finished interior surfaces of the press side frames.

Control of normal movements of the press is effected by a foot lever located at the operator's left. Constant depression of this pedal causes the moving crosshead to approach the work, engage the work at the pre-set pressure and return, again to repeat the cycle. If the operator removes the foot from the pedal, the crosshead movement immediately stops.

For die-spotting, a hand lever is provided at the face of the left side frame, which causes slow movement or "inching" of the moving crosshead.

Nash Shipments to Canada Up

Shipments of Nash automobiles to Canada during the last three months of 1937 were 51 per cent ahead of those of the same period in 1936, according to Claus Anderson, Canadian sales manager of the Nash Motors Division of Nash-Kelvinator Corp.

Retail deliveries of Nash cars in Canada during the final quarter of 1937 also showed a considerable increase, Mr. Anderson reported. They were 31 per cent ahead of the last quarter in 1936.

Government Calls for Tire Bids

The Procurement Division of the Treasury Department has called for bids on Feb. 7 for \$1,500,000 worth of tires for Government use from April 1 to Sept. 30.

Bids called for a wide range of sizes for automobile, airplane and bicycle use.

Successful bidders will sign contracts which carry the clause designed to prevent collusive bidding. The clause provides that "the undersigned represents that the prices in the bid are neither directly nor indirectly the result of agreement with any other bidder."



New self-contained, individually powered hydraulic press built by the Farrell-Birmingham Co., Inc., Ansonia, Conn. Capacity of the press may be varied between 50 and 300 tons



AUTOMOTIVE ABSTRACTS

Fischer-Tropsch Process

According to an item in the Transactions of the French Academy of Sciences, it has been found that the addition of a few thousandths parts of potassium carbonate to the iron catalyst used in the hydrogenation of carbon monoxide at atmospheric pressure in the Fischer-Tropsch process materially increases the yield of liquid hydrocarbons.

Finely divided iron without the addition of potassium carbonate gives 25 gm. of a very volatile gasoline per cu. meter of the gas treated, and that even when the catalyst is new. Catalysts to which the carbonate has been added behave at first the same as the iron alone; but after about 20 hours there appear oils and solid paraffins at atmospheric temperature.

After about 50 hours the catalytic process becomes stabilized and continues without change for about eight days. The yield, on the basis of one cubic meter of the mixture $\text{CO} + 2 \text{H}_2$, is then 20 gm. of gasoline, 10 gm. of oil, and 15 gm. of paraffin. This phenomenon is due to a radical change in the structure of the catalyst.

It is found that after some 20 to 30 hours of service, the catalyst to which carbonate has been added contains a solid solution of potassium ferrite in sesqui-oxide of iron. This solid solution is formed progressively at the expense of magnetite, which may disappear almost entirely. It is the latter which promotes the formation of hydrocarbons of high molecular weight.—*Chimie et Industrie* for November.

Motorcycle Engines

For some years designers of motorcycle engines generally have realized the need for increased rigidity of crankshafts to obtain smoother running engines and to relieve the main bearings of load due to shaft deflection. Investigations made in 1935 showed that in a $30\frac{1}{2}$ -cu. in. single-cylinder engine with internal flywheels, under a load of 3500 lb. on the crankpin (which is assumed to be the maximum load on the pin during the firing stroke after allowing for inertia forces), the flywheel rims at a point opposite the

crankpin would spread from 0.017 to 0.022 in. (in three different engines) at 4000 r.p.m.

In one of these engines the spread at 4000 r.p.m. was reduced to about 0.008 in. by increasing the rigidity of shafts and flywheels. There was also considerable distortion of the built-up crankshaft due to side pull of the chain, the sprocket on the crankshaft overhanging the bearing by a considerable distance. Tests were made also on an engine (of 21.3 cu. in. displacement) in actual operation, the run-out of the flywheel being recorded by a suitable apparatus. This showed a maximum run-out of 0.0175 in. at about 3000 r.p.m., which was reduced to about 0.0075 in. by considerable alterations in the crank assembly. The peaking speed of 3000 r.p.m. for the run-out corresponded with the calculated maximum net force (explosion minus inertia force) on the crankshaft.

Flywheel weight is an important item in a single-cylinder motorcycle engine. If the flywheels are made too large in diameter (in order to make them more effective without increasing their weight), the crankcase will become expensive and lose in rigidity. If the flywheel capacity is reduced, the engine has better acceleration, but the transmission will be hard, excessive work will be put on the shock absorber, and the engine is easily stalled when engaging the clutch in traffic. With a machine of 21.3 cu. in. displacement, the time of acceleration from 15 to 30 m.p.h. was decreased from 8 to 6 seconds if the flywheel polar moment of inertia was reduced from 0.041 to 0.022 ft-lb-sec.⁻².

For normal single-cylinder motorcycle engines the following polar moments of inertia (only the rim, balance weight and crankpin being figured) are considered suitable: 15.2 cu. in. displacement, 0.018 ft-lb-sec.⁻²; 21.3 cu. in., 0.027 ft-lb-sec.⁻²; 30.5 cu. in., 0.041 ft-lb-sec.⁻².

As regards balancing, all of the rotating weight should be balanced, together with from 65 per cent of the reciprocating weight in low-speed to 45 per cent in very high-speed engines.—V. Page in *Journal of the Institution of Automobile Engineers* for January.

English Car Imports

Opel and Fiat Small Models Taking Larger Slice of British Market

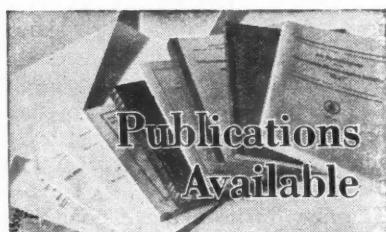
Opel, General Motors Corp. German subsidiary, and Fiat cars are reported to be encroaching to an increasing extent on the English home market for small automobiles. The intelligence is confirmed by an analysis of import returns, recently issued, for October and November last and those for the whole of the statistical year ended Sept. 30, 1937.

Foreign cars imported into England during the year 1936-1937 numbered 17,993, an increase of approximately 88 per cent as compared with 9580 during 1935-1936. The increase was largely accounted for by imports from Germany and Italy.

In October and November last, German imports increased from 183 to 736, and Italian from 191 to 514, the average declared values being approximately: German cars, \$500; Italian cars, \$350.

These values indicate that the cars were mainly Opels from Germany and Fiats from Italy, and probably the smallest models of both makes—the 1.1 liter (approximately 67 cu. in.) Opel selling in England at prices ranging from \$675, and the 0.57 liter (approximately 34.8 cu. in.) "500" Fiat with prices from \$600.

Imports from France also increased considerably during October and November, but the number received from the United States and Canada during those months increased only from 1721 in 1936 to 1781 last year, with average declared values of \$1,100 and \$1,240, respectively.



The Machinery and Allied Products Institute, Chicago, has published in pamphlet form the statement made by its president, William J. Kelly, before the Senate Committee on Unemployment and Relief. The publication is entitled, "What Congress Can Do to Build Confidence, Increase Employment, and Restore Recovery."

A 28-page booklet, giving summaries by industries of practical applications of air power, has been compiled by The Curtis Pneumatic Machinery Co., St. Louis, Mo.*

Application of mohair velvet upholstery to automotive vehicles is discussed in a booklet recently issued by L. C. Chase & Co., Inc., New York City.*

"U. S. Royal Cords and Cables," an illustrated wire manual providing wire and cable

Last Year's Truck Output Lead '36 by 16%

Production of passenger cars within the price group \$751-\$1000 forged ahead in 1937 almost 90 per cent as compared with the 12 months' volume of 122,058 chalked up for the preceding year. The appended statistics reveal this particular group achieved the highest per cent gain for the period under consideration, while passenger cars in the \$3001-and-over bracket finished the year strong with a 31 per cent gain, or 107 more units than in 1936.

Total truck production for the 12 months of 1937 garnered the substantial lead of 16 per cent over the 818,377 units manufactured in the United States and Canada during 1936.

Passenger Car Production by Wholesale Price Classes (U. S. and Canada)

	Twelve Months		Per Cent Change	Per Cent of Total	
	1937	1936		1937	1936
Under \$750	3,789,890	3,619,758	+ 4.9	93.15	95.32
\$751 to \$1000	231,789	122,058	+89.8	5.70	3.21
\$1001 to \$1500	30,720	39,912	-23.1	.75	1.05
\$1501 to \$2000	11,633	11,532	+ 1.0	.29	.39
\$2001 to \$3000	4,052	4,324	- 6.3	.10	.11
\$3001 and over	410	313	+31.0	.01	.01
Total	4,068,494	3,797,897	+ 7.2	100.00	100.00

Truck Production by Capacities (U. S. and Canada)

	Twelve Months		Per Cent Change	Per Cent of Total	
	1937	1936		1937	1936
1½ Tons and less	884,582	760,125	+16.3	93.31	92.88
2 to 3 Tons	37,506	38,804	- 3.4	3.96	4.74
3½ Tons and over	13,844	8,667	+60.0	1.46	1.06
Special and buses	12,089	10,781	+11.5	1.27	1.32
Total	948,021	818,377	+16.0	100.00	100.00

data and specifications, has been brought out by the Wire Division, United States Rubber Products, Inc.*

Latest publication issued by the Progressive Welder Co., Detroit, is bulletin No. 3803 on **hydraulic punching units**.*

Reporting progress made by the national organizations operating under grants of money from the **Automotive Safety Foundation**, New York City, Paul G. Hoffman, president of the Foundation and of the Studebaker Corp. has prepared a booklet entitled "A Rational Approach to An Emotional Problem."**

A booklet giving numerically arranged lists of competitive **ball bearings** together with the corresponding New Departure numbers; definitions of letters and letter combinations used by various manufacturers to identify bearing characteristics; also information on specifications and tolerances has been brought out by the New Departure Division of General Motors Corp., Bristol, Conn.**

The **Motor and Equipment Wholesalers Association**, Chicago, has issued a pamphlet entitled "M.E.W.A.—What it is. What it does. How it does it."**

Simplified practice recommendation R169-37 on **machine, carriage, and lag bolts** (steel) is now available at 5 cents per copy from the Government Printing Office, Washington, D. C.

The Cimatool Co., Dayton, Ohio, has published a descriptive leaflet on precision **gear tooth chamfering, burring, and milling**.*

Vol. 1, No. 1, of a new publication "The **Neoprene Notebook**" has been issued by the Rubber Chemicals Division, E. I. du Pont de Nemours & Co.*

Controlled air circulation is discussed in the new bulletin on rotary ventilators pub-

lished by the Swartout Co., Cleveland, Ohio. It contains design and capacity information.*

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

Calendar of Coming Events

Foreign Shows

German Motor Show, Berlin, Feb. 18-March 6, 1938

Leipzig, Trade Fair, March 6 to 14, 1938

Conventions and Meetings

American Society for Testing Materials, Spring Regional Meeting, Rochester, N. Y.

March 7, 1938

Machine and Tool Progress Show, Detroit.....March 9, 1938

SAE National Aeronautic Meeting, Washington, D. C.

March 10-11, 1938

SAE National Passenger Car Meeting, Detroit,

March 28-30, 1938

American Foundrymen's Association, Foundry Show, Cleveland.....May 14-19

Books

of automotive interest

FUNDAMENTALS OF MACHINE DESIGN, by C. A. Norman, E. S. Ault, and I. F. Zarobsky. Published by the Macmillan Co., New York.

This book is intended as a textbook for classes in machine design. Two of the authors are professors of that subject, while the third is professor of the closely related subject of mechanical engineering.

In an introductory chapter on Design Procedure and Standardization the authors point out that the product of the machine designer's effort must be made available at reasonable cost and operate properly over a useful life without undue attention; it must be safe to use and attractive in appearance, and above all it must perform its functions in such a way as to justify the expenditure of labor and material necessary to plan and build it. The machine designer therefore should possess a broad scientific training, an understanding of human wants, a knowledge of manufacturing methods and the necessary ingenuity and resourcefulness to apply this knowledge in the development of useful and practical articles.

This first chapter is followed by chapters on Strength of Materials, Engineering Materials, and Manufacturing Processes, all of which subjects are closely related to that of machine design proper. The remainder of the book is divided into numerous chapters, each dealing with some particular machine element, such as Riveted Joints, Welded Joints, Shafts, Keys and Permanent Couplings, Plain Bearings and their Lubrication, etc. Each chapter is followed by a series of problems for the student to work out. Problems encountered in the design of automotive engines and transmission units are well represented.

Wright Gets Navy Engine Order

A contract totaling \$1,008,217.40 for construction of 56 airplane engines and spare parts has been awarded by the Navy Department to the Wright Aeronautical Corp. of Paterson, N. J.

The engines, the Department said, are for the 21 two-engine flying boats now under construction in Baltimore at the Glenn L. Martin Co. plant.



PHOTO, COURTESY PARAMOUNT

Stars Sell

By HARRY CHAPIN PLUMMER

THE automobile industry benefits from the steadily growing association of American motor vehicles and motion-picture films, not only in this country but overseas. Today one of the liveliest of auxiliary sales forces for the car, truck and tractor producer is the photoplay, into which every type, class and make of vehicle makes its way and sometimes, indeed, is featured in a role secondary only to that of the most glamorous star.

Long experience has proved to the Ho'lywood director that automobiles, as well as his biggest box-office draws among the players, have definite personalities. Like many of the human cast they are "typed" in the public mind. A long, racy American or foreign model, better than a page of dialogue, may reveal at a glance the financial status of a character. No light matter, but a serious problem in casting, is the employment of a car in a picture. It is just as important as the picking of a character actor for a special role. The car that can give a magnificent performance in speeding, in starting and stopping, in a hair-pin-turn maneuver, in hill-climbing or descending, and that can "take it" when it comes to downright abuse, is just as essential on the lot or on location, whether at Hollywood or at freight production centers, as a Shirley Temple, Katherine Hepburn, Gary Cooper, Ronald Colman or Paul Muni or the most swagger "set" or latest lighting device. If the script calls for a motor car or motor truck in any extended action, that unit of "property" almost invariably becomes a requirement vital to the success of the picture.

As a determining influence in automotive style the talkie, both in its pictorial and its sound aspect; and, too,



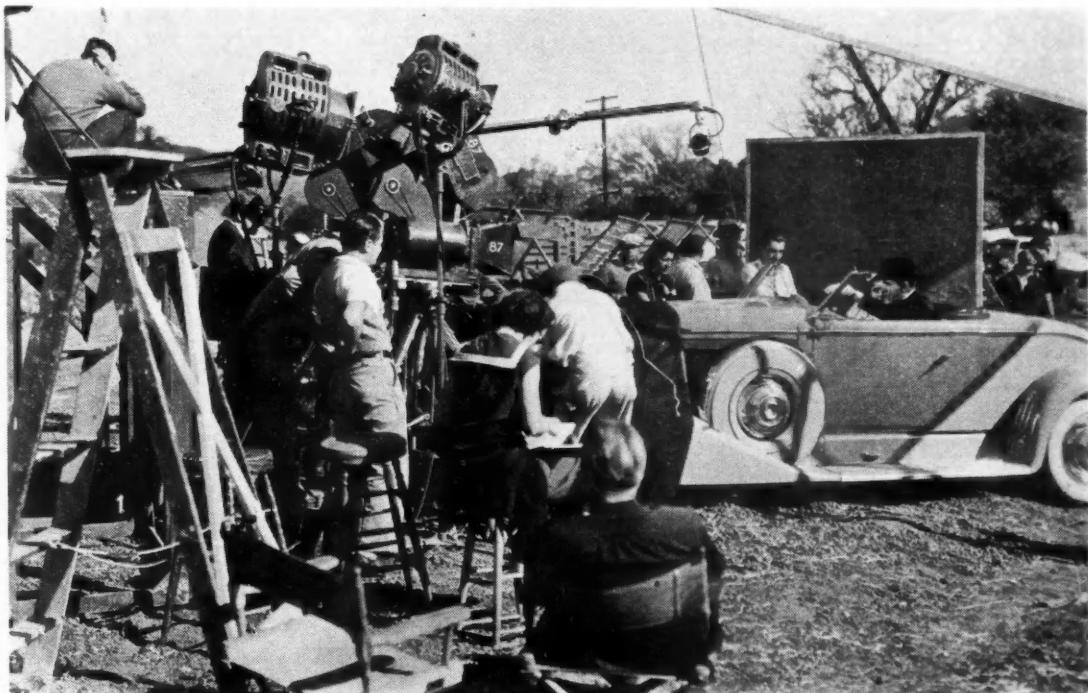
A few of the stars who make the headlines and have shared their position of prominence with automobiles made in the United States are (1) Mae West, (2) Bing Crosby, (3) Frances Dee, (4) George Raft and (5) Marlene Dietrich

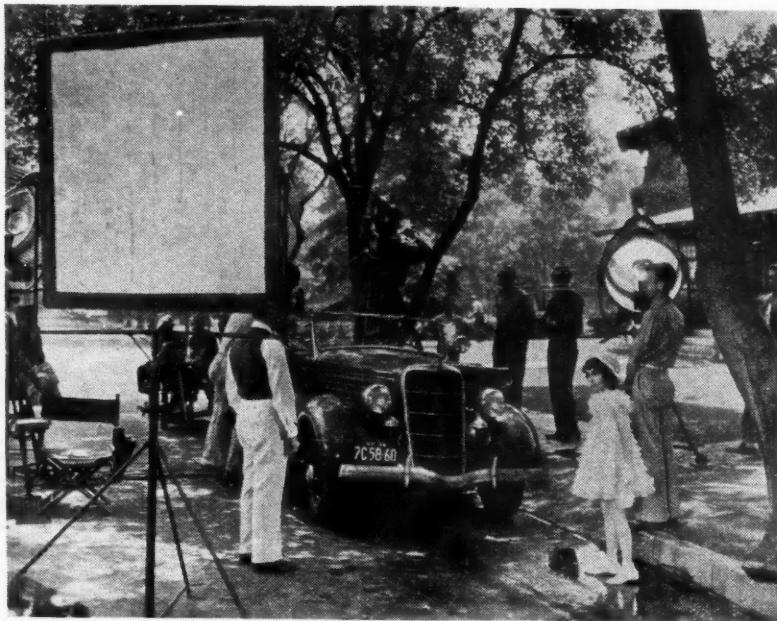
All Cars

in its spoken dialogue directly or by implication, is registering its power in increasing degree in great metropolitan centers along "Main Street," in cross-road hamlet and in the farthest reaches of American commerce beyond the seas. It is, indeed, in the most unlikely places that, ofttimes, sales or rentals of car or truck directly result from the showing of a film in which a particular

model, shooting across the screen in a dramatic sequence, happens to catch the fancy of a spectator thousands of miles from the production plant or major distribution centers of that individual make. Even the construction principles and accessory equipment of foreign cars entrenched in their own markets are influenced by the screen display and screen performances of American vehicles hitherto

Gracie Allen and Edward Everett Horton share honors in this scene with a sports roadster. Note the care that has been taken to kill the glare of the sun and show the car as well as the actors to best advantage





The lack of sunlight in this view has been overcome by strong lighting equipment. The front end of the Ford is just as important as little Cors Sue Collins as she appeared in this scene of "Three Married Men."

scarcely discountable as competitors.

I have seen screen audiences of four continents lured into their theaters by enticing posters announcing this or that Hollywood favorite, yield their average admission price at the box-office and come forth, two or three hours later, an appreciable percentage sold on a particular motor car which had contributed to their entertainment and a percentage of that percentage actually become the buyers of cars of that make, pattern and model from local dealers, the direct result of the involuntary selling ally, the film.

In Tetuan or another of the hinterland cities of Spanish Morocco and in Larache or Alcazarquivir, on its rainy west coast, I have seen fezzed, turbanned or hooded Moors—árabes, they call them there—intently watching the performance of a standard American car, the while missing nothing of the blond star's allurements in a Hollywood gangster, or play-boy, or western picture. In Venezuela's Caracas, Puerto Cabello or Barquisimeto, I have seen throngs, downstairs recruited from descendants of Old Spain's *Conquistadores* and in the balcony recruited from native Indian and *mestizo* elements of the population, follow with equal interest and concentration the

progress of one of our *Yanqui* cars in a current release. The sales prospects there developed, were by no means confined to the more aristocratic lower floor. Those swarthy *indigenos* have money when the coffee, sugar, *cacao* and tobacco are harvested—and buy cars. In Paris, where film entertainment is almost as costly as the "legit" theater, I have seen smart cosmopolitan audiences similarly attending these "sales demonstrations," as accidental as they are unintentional, and from comment about me, have realized that comparisons were being drawn that were distinctly unfavorable to their own Continental or English makes of car. In San Juan, capitol of our Puerto Rico, and in Willemstäd, in Dutch colonial Curaçao, farther down the Caribbean, I have seen that same mental appraisal at work and in both localities, as diver-

gent sociologically as the Poles, I have seen that influence translate itself into bills of sale from dealer to—"movie" patron.

In Spain, before the revolt and civil war, I heard repeated complaints from the representatives of the big American picture groups which still maintain their branch plants at Barcelona, that the resistance they encountered when they sought to protest legislation or decree designed to hamper their operations or to levy prohibitive taxes, although emanating from the Spanish native production units, was stiffened by the united support of the two big Spanish motor-manufacturing companies—the Hispano-Suiza and Mercedes-Benz. Even those two makes, favored only by princes and potentates within and without the Peninsula, because of their excessive cost, had felt the competitive influence engendered by Hollywood's "celluloid salesman."

With the slogan, "Trade follows the film," the British Parliament, as long as a decade ago, entered upon a systematic campaign to reduce direct American picture imports and passed an Act requiring 20 per cent of the American and foreign releases to be produced in British studios of the Hollywood producers. The 10-year period ends in March (1938) and next month (February) a new bill is to come up setting the percentage at 50, instead of 20.

"Big Business" of the United States is now taking full cognizance of the benefits upon which actually it

Charles Barton directed Frances Drake in this scene from "Sudden Death." The car is a Supercharged Auburn





The moving picture industry in all ways is very much motorized. When production is away from the studio one of these trucks is sent along fully equipped to make sound pictures

is capitalizing from the American film as an auxiliary sales force and particularly so in the export markets of the world. Motor boats, electric refrigerators and all manner of electrical goods, radio sets, sewing machines, office equipment, millinery, women's gowns and men's clothing, toilet accessories and almost every phase of merchandise turned out in our factories and shops, are impelled in their saleability abroad, as well as at home, by Hollywood's product. The pre-eminent reason for this is that the talking picture from the United States leads in almost all foreign fields excepting those where, by arbitrary mandate of individual government, it is so harassed, restricted and penalized as to be in whole or in part barred. Even in those happily few and isolated instances, the raising of the barriers has been motivated not so much by fear of the eventual supremacy of the American film *per se* as by the tremendous influence it wields in industrial and trade channels, even in political and social life. Belated registration of these facts at last has prompted our Federal Government to awaken to the need for some measure of cooperation with the industry which has developed this auxiliary sales force and with those lines of production already benefitting, or due to benefit, from its operation. In short, Uncle Sam, rubbing his eyes and still yawning, sees now in the Hollywood producing studio and its elaborate distributing mechanism at home and overseas something that is more than just another potential object of revenue taxation.

Our Government's statistics of film

exports are inadvertently both unrevealing and misleading. The total of exports for the year 1936, for example, was 209,651,401 linear ft., valued at \$4,531,639; that for 1935, 199,690,621 linear ft., valued at \$4,597,239. This paucity of outgo is due to the fact that only positives are shipped abroad and from these, in foreign production and distributing centers, negatives are developed and in turn from these negatives second positives are made and then shipped cut to other markets abroad, as exports not from the country of origin, but from secondary bases. A goodly percentage of these re-exports are in the form of "dubbed" or foreign-language dialogued versions of the original English-text positives brought in from Hollywood. For these "dubbed" versions, outstanding actors and actresses of the second language are recruited, whose voices most closely resemble in quality, resonance, timbre, those of the American screen favorites assuming the original roles—and the sound duplication oftentimes is "uncannily" true, even to the speech mannerisms

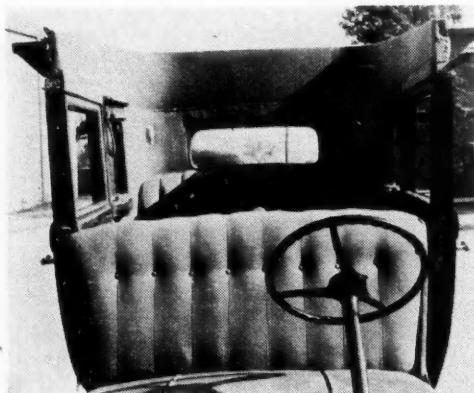
of the American artists. Long and arduous work has to be done by the foreign script writers in the new language to insure dialogue lengths corresponding, in number of syllables and even as to inflections, to the English text. Then, after the tireless preparation and rehearsal by the foreign-language substitutes, the dialogue is recorded upon a new strip of film cemented to the original pictorial and sound tracks and the English text discarded. Before the Spanish war many pictures "dubbed" in American branch studios or native Spanish production units were distributed not only throughout Spain and Spanish Morocco, but exported as "Spanish manufactured product" to the Spanish-speaking countries of the Western Hemisphere. The "dubbing" for the Spanish market, excepting that for Metro-Goldwyn-Mayer Iberica, whose studio at Barcelona continues to function, is now accomplished chiefly in the Paris studios of the American companies.

When we examine the overshadowing proportion of American picture releases in certain foreign countries to those of imports from other lands and to native film production, we begin to sense the sweeping trade supremacy that eventually may result for American products in general, with motor vehicles well up toward the head of the list.

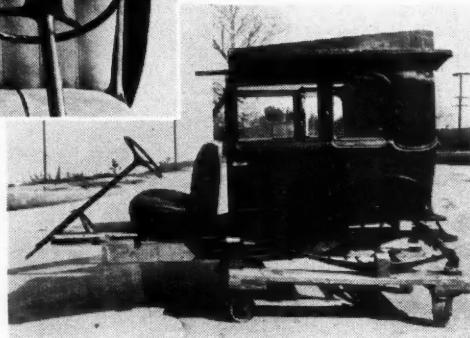
Taking as an example, at random,



This Cadillac is the center of attraction as Barbara Stanwyck, Joel McCrea, Stanley Ridges and Harry Bruno get ready for another scene in "Internes Can't Take Money" with a replica of the Grand Central Station in New York as the locale



PHOTO, COURTESY UNIVERSAL



In order that the individuals will photograph properly and will appear on the screen free of shadows, a specially constructed body without a top and detachable in sections, is used in the filming of New Universal pictures. The arrangement makes it possible to focus lights throughout the entire interior. A piece of frosted glass, is placed behind the rear window. On this, and from the rear, is projected the moving scenery. Road bumps, and other natural conditions inside the automobile while moving are created by rocking the stand on which the whole equipment is placed.

Switzerland, peopled by three races and speaking three languages and drawing its inspiration in social influences, in culture, in commercial leanings from Germany, France and Italy; 53 per cent of its film imports comes from this country. Take The Netherlands, a Teutonic nation speak a tongue closely akin to German; 60 per cent of the films released in the metropolitan port city of Amsterdam are of Hollywood production. Take Austria, another Teutonic, German-speaking State and with Germany as her neighbor; of 343 films shown, 115 are from this country, 112 from Germany, 21 from Austrian studios. Take Czechoslovakia, a land with an appreciable proportion of population of German blood and German speech; of the aggregate imports, almost half are from the United States, while German films share the other half with those from Austria, France, Great Britain, Russia. Far away in the Argentine, where British influence permeates every phase of economic life and especially so in Buenos Aires and the larger centers, with German the second great foreign influence; of 516 feature films released, 366 are from the United States, 42 from Germany, 39 from France, 34 from the United Kingdom, 18 from home studios and 17 from Spain. Norway shows 269 films, 169 are American, 41 German. Of Portugal's total imports, 56 per cent come from the United States. Hungary takes 1043, of which 441 are American, 245 home-produced and 206 German. In Algeria, where everything con-

ceived, invented, designed, manufactured that is French has the "right of way," 130 feature films are shown, 60 of them French, 45 "dubbed" American, 10 "dubbed" German. And in Germany producer of both "quality and quantity" in pictures; of 180 released, 115 are German, 31 American, 17 Austrian, 5 French. Finland, importing a total of 88, takes 52 American, 11 German, 3 French, and from Sweden, the nation whereof the Finns are an offshoot, 5. Then San José, capitol of Costa Rica, in Central America, shows 300 American pictures out of a total of 456.

One of the most unique of Hollywood's many strange professions is that of the automobile rental brokers whose patrons are a half dozen studios. There are, perhaps, a dozen of these who maintain large fleets of motor cars of all makes and vintages, ranging from the decrepit French taxi of World War days, through pleasure cars of all types and ages, down to the most modern racing-machines.

Regardless of story requirement, it is seldom that a Hollywood director cannot fill his automotive needs in a matter of five minutes or a half-hour. One automobile broker specializes in Model "T" Fords, those ancient high-wheels which were the real pioneers of the modern highway. Another has a fleet of trucks of every imaginable variety, from panel delivery wagons to giant dump-carts. Others specialize in foreign cars, used by the screen now and then to lend authenticity to pictures whose *locale* is laid abroad or to add a touch

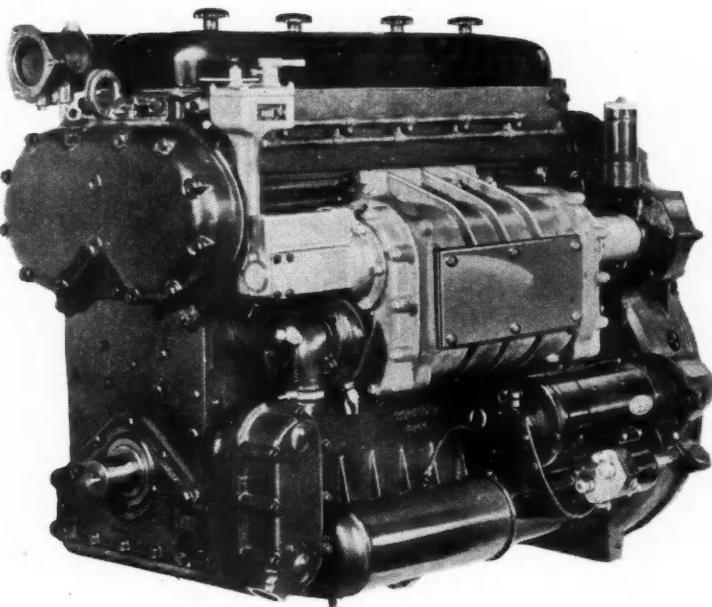
of "swank" to American plots. All of these brokers issue catalogs, so that the director can thumb his way through a pictorial history of the automobile and personally select the machine he wants without ever leaving the set.

Picture producers, through practical experience, have found it cheaper to pay rentals ranging from \$15 to \$75 a day for automobile "types" than to maintain their own garages. Paramount, for example, owns only six motor cars used solely for picture purposes. Two of these are ancient taxicabs imported from France and the remainder are old Fords kept at the Paramount "ranch" and employed mostly in the making of "westerns." Occasionally one of the big fleet of Buicks which the company maintains to fill its multitudinous transportation needs is used in making a film. When a police car is required, the "prop man" just paints "P.D." on the sides.

Once upon a time the studios borrowed cars from Hollywood dealers or sales agencies, who were glad to get the free advertising. But not any more. Russell Pierce, head of the property department explains this: "Any time we get anything for nothing, we pay for it ten times over in a round-about-way. And if we get one little scratch on a new car, the firm that lent it expects us to buy a new buggy."

The *locale* of the story, its subject matter, the personality of the "star" and the role he or she is playing, and technical aspects of the scenes laid out in the script of a picture all must be taken into consideration by the director in "casting" a motor car. In "Bluebeard's Eighth Wife," for example, Gary Cooper's use of Loretta Young's big American-built car in scenes laid in Paris is a more potent indicator of wealth than would be the employment of the most expensive French car. So far as this particular picture is concerned, the luxurious American machine enjoys the glamour of the "imported" article. Conversely, Edward Everett Horton drives a gleaming Rolls-

(Turn to page 158, please)



Six-cylinder Model 6-71 engine with blower and accessories on left-hand side

GM's New Diesels

GENERAL MOTORS' new automotive-type Diesel engine, which was announced to the public on Jan. 19, is a two-stroke uniflow engine which is being produced in one cylinder size (4 $\frac{1}{4}$ by 5 in.) but in three, four, and six-cylinder types. It is known as the Series 71 and the various models are referred to as Model 3-71, Model 4-71 and Model 6-71. Maximum-power ratings of the three models are 80, 107, and 160 hp., respectively, at 1800 r.p.m., and continuous-power ratings, 45, 60, and 90 hp., respectively, at 1200 r.p.m. The maximum power rating is based on a b.m.e.p. of 82.7 lb. per sq. in. and the continuous power rating on a b.m.e.p. of 70 lb. per sq. in.

Weights of the three engines, including starting motor, governor, oil cooler, oil filter, and fuel filter, are 1160, 1330, and 1635 lb., respectively, which makes the specific weights 14.5 lb., 12.4 lb. and 10.2 lb. per hp. on the basis of the maximum rating, and 25.8 lb., 22.2 lb. and 18.1 lb. per hp. on the basis of the continuous rating. Necessary equipment not covered by the weight figures given includes a generator, cooling fan, oil-bath air cleaner, air-intake elbow, and engine mountings.

These engines develop their maximum torque between 800 and 1000 r.p.m. This torque is 283 lb-ft. for the three-cylinder, 375 lb-ft. for the

four-cylinder, and 562 lb-ft. for the six-cylinder, or about 1.32 lb-ft. per cu. in. displacement.

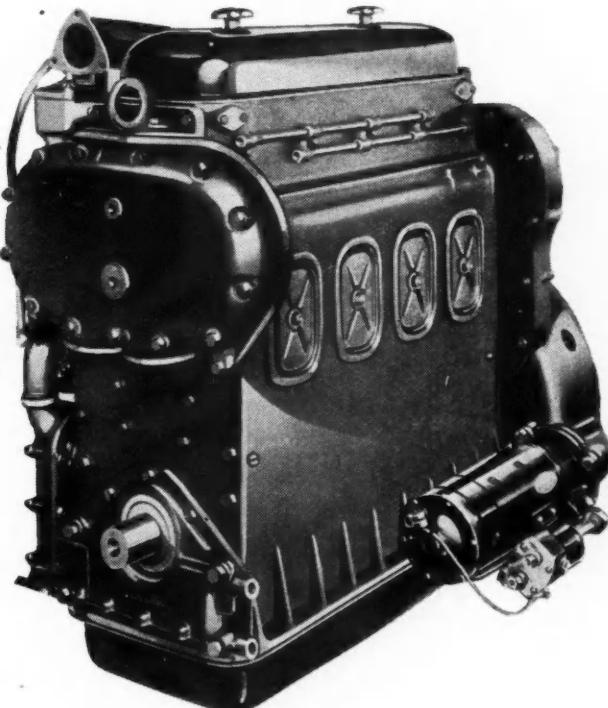
The reason for the choice of the two-stroke cycle for these engines is explained as follows in a statement by F. G. Shoemaker, chief engineer

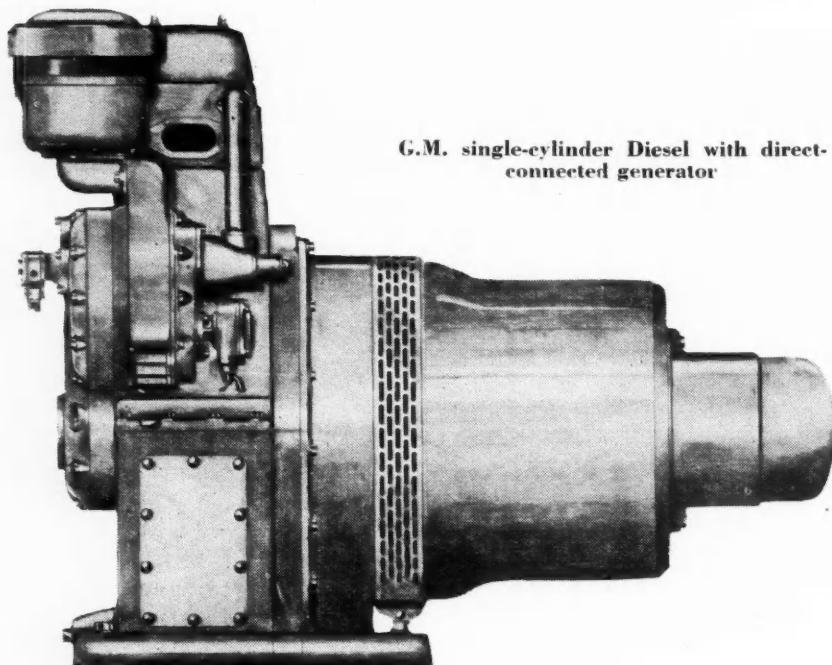
of the Detroit Diesel engine division of General Motors Corp.:

"The greater fuel economy of the Diesel engine is due to its much higher compression ratio and explosion pressure. Obviously, these higher pressures require stronger cylinders, connecting rods, crankshafts, bearings, and so forth. Using the same materials and manufacturing methods as in commercial gasoline engines, and maintaining the same degree of reliability, this necessarily results in a larger and heavier engine, unless the Diesel engine principle permits making an engine of a fundamentally different type than a gasoline engine. Fortunately, this is possible by making the Diesel engine two-cycle."

"The gasoline engine burns a mixture of gasoline vapor and air, which must be in proper proportion to ignite. This requires that the cylinder must be cleaned of burned gas through the exhaust valve by one stroke of the piston, and then the required amount of mixture drawn in through the intake valve by another stroke of the piston, thus preventing any of

Four-cylinder Model 4-71 with blower and accessories on right-hand side





G.M. single-cylinder Diesel with direct-connected generator

the fresh charge from mixing with the exhaust gases or being prematurely ignited if they are sufficiently hot. The Diesel engine, however, fills the cylinder with air only and does not spray the fuel into the air until the valves have closed and the air has been compressed up to the ignition point of the fuel. Hence, in a Diesel engine it is possible to have both the inlet and the exhaust open at the same time and to push out the burned gases with the incoming fresh air; even a little extra air may be added to make up for the slight mixing when the two come together. If the air is supplied by a blower under a low pressure, this scavenging and filling can be done while the piston is near the bottom end of the stroke, and the cylinder thus made to operate with only two piston strokes, or two-cycle.

"Thus a two-cycle Diesel engine is simply a conventional four-cycle type gasoline engine structure, made stronger to withstand the higher explosion pressures, with the valves arranged to be open at the same time, and with a blower added to fill the cylinders and push out the exhaust gases. The additional power resulting from twice as many power impulses per cylinder more than offsets the added weight of the stronger parts and the blower, and thus places the two-cycle Diesel engine on a direct competitive basis with gasoline engines as regards size, weight and power, with the added advantage

of a very considerable saving in fuel."

The specific fuel consumption of these engines, by the way, is given as 0.45 lb. per hp-hr.

Sectional views of the three-cylinder engine Model 3-71 are reproduced herewith, together with photographs of the four- and six-cylinder engines and of a wash drawing of a single-cylinder unit direct-connected to a generator. The engine has a bore of 4 1/4 and a stroke of 5 in., which makes the displacement per cylinder approximately 70.9 cu. in. and total displacements of the three models 212.69, 283.58 and 425.37 cu. in., respectively. The cylinders are in a single casting and are provided with dry liners. An inspection of the transverse section makes it evident that great rigidity in the vertical direction is imparted to the block by the very deep and nearly plane side walls, and great rigidity in the horizontal plane by the deck at the bottom of the cylinders, of a width equal to considerably more than twice the cylinder bore. The main bearings are supported from this deck by solid partitions or bulkheads.

Cylinder heads also are in a single casting in all models, and contain

the dual exhaust valves and the injector unit, the latter in the cylinder axis. Valves are operated through pushrods and rocker arms, from a camshaft located in the upper part of the cylinder block and driven by a train of gears which also drives the blower. It will be seen in the longitudinal section that the gears for the camshaft and blower drive are located at the flywheel end of the engine, where the crankshaft speed is most nearly uniform (absence of torsional vibration). From the rear elevation and the longitudinal section it can be seen that the drive is cushioned and damped. The water pump, fuel-transfer pump and governor are located on the blower and driven through it.

The oil pan and the valve covers are steel pressings. The blower, which is of the Roots type and has two three-lobed rotors, is flange-mounted on the side of the cylinder and discharges directly into an air box surrounding the cylinders. There are inlet ports in the cylinder wall and in the liner at the bottom end of the stroke, through which air from the air box enters the cylinder as the inlet port is uncovered by the piston. During the up-stroke the air is compressed in the cylinder in the ratio of 16:1. Fuel is injected into the combustion chamber by a combined pump and spray nozzle located between the valves in the cylinder head and operated from the cam-shaft through a tappet rod and rocker lever, the same as the exhaust valves.

The engine thus operates on the uniflow principle, air entering the cylinder through ports at the bottom and products of combustion escaping through valves in the cylinder head. As already stated, there are two exhaust valves in each cylinder; they have 45 deg. seats, a diameter of 1 11/16 in., and a lift of 3/8 in.

The piston has a number of unusual design features. It is provided with a rim at the top which comes very close to the under side of the cylinder head when the piston is at the end of the up-stroke, and forms a pan-shaped combustion chamber that is shallowest at the center and

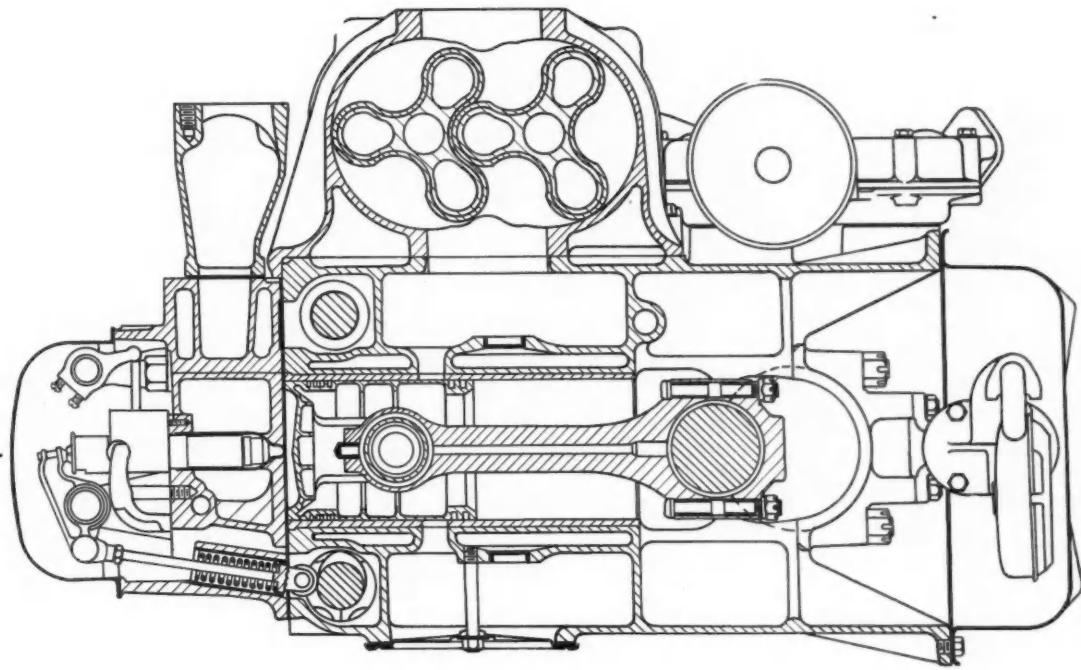
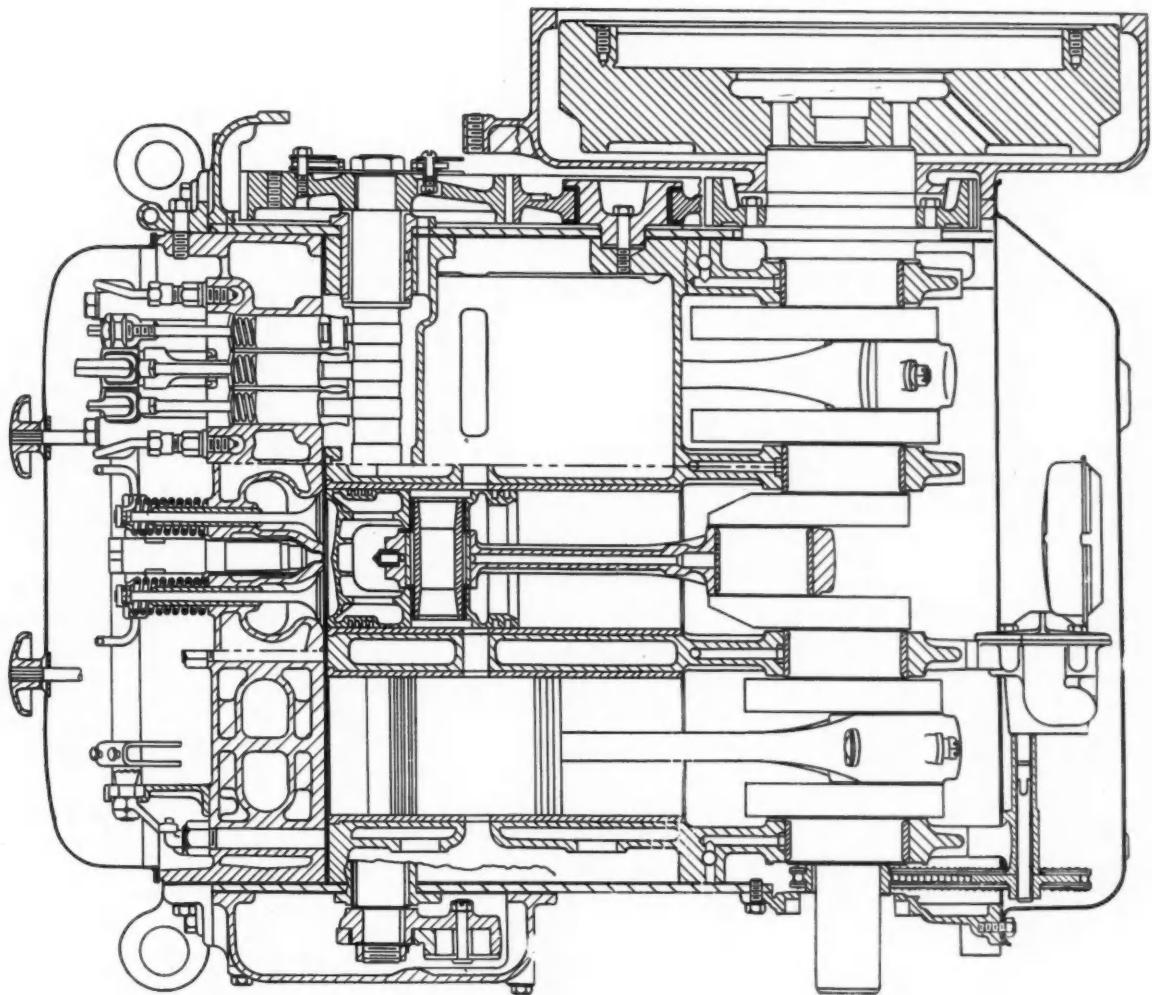
(Turn to page 159, please)

Capacities of GM's Model 71 Two-Stroke Diesel Engines

	Model 3-71	Model 4-71	Model 6-71
Lubricating Oil System, qts.	8 1/2	10 1/2	15 1/2
Fuel Oil Tank, gallons	30	40	55
Cooling Water, gallons	11	12 1/2	15 1/2

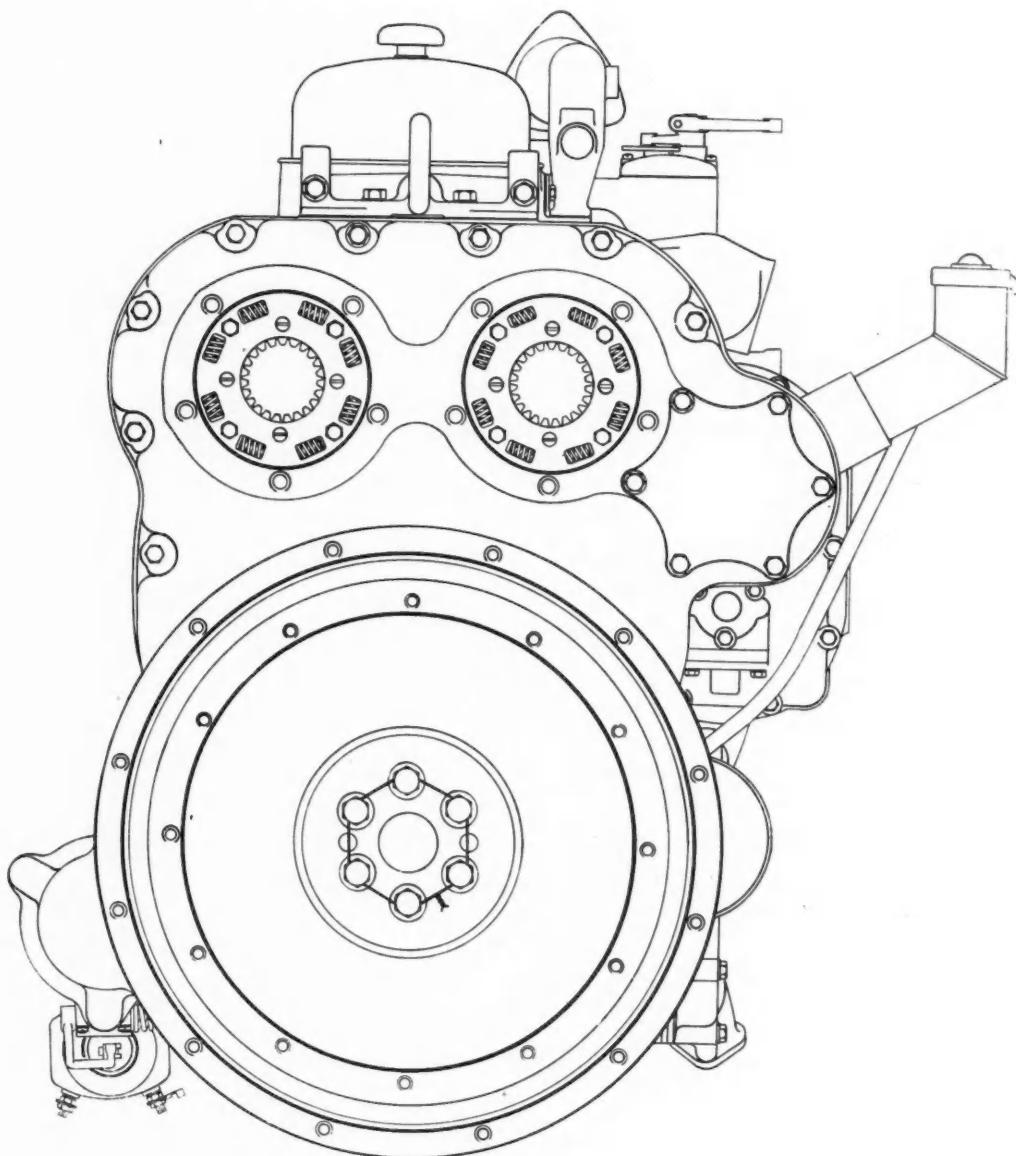
GM's Model 3-71 Diesel Engine

No. 12 of the Second Series of
AUTOMOTIVE INDUSTRIES Engineering Drawings.



GM's Model 3-71 Diesel Engine

Rear View



THIS new two-stroke, uniflow engine is to be built by General Motors Corp. in a single cylinder size of $4\frac{1}{4}$ in. bore and 5-in. stroke, in various cylinder numbers from one up. The three-cylinder model here illustrated has a novel balancing system. There are two parallel shafts on opposite sides of the cylinder block near the top thereof. Each shaft carries balance weights at opposite ends, angularly spaced by 180 deg., and the two shafts rotate in opposite directions, so that the resultant of the centrifugal forces on the four balance weights is a vertical rocking couple at all times equal and opposite to the rocking couple produced by the three crank trains.

The six-cylinder Model 6-71 develops a continuous output of 90 hp. and a maximum of 160 hp. A three-lobed Roots-type blower is used for scavenging and is bolted against the side of the cylinder block. Scavenging is on the uniflow principle, air entering the cylinder through ports at the bottom and products of combustion escaping through dual valves in the cylinder head. The specific fuel consumption of these engines is given as 0.45 lb. per b.hp-hr. and the specific weight of the six-cylinder on the basis of continuous output is 18.1 lb. per hp. The drive for the camshaft and for the blower is taken from the flywheel end of the crankshaft.

Just Among Ourselves

Shadows on the Wall

DISTRIBUTED recently to all stockholders in General Motors was a pamphlet titled "The Worker in General Motors". Over the signature of Alfred P. Sloan, Jr., it summarizes the Corporation's recent policies in labor matters and charts the welfare of General Motors' workers since 1925. Charts show that average hourly money wages of General Motors' workers have been well above the average of those for other American industries and that weekly wages in money have followed the same trend. An additional note shows that real wages of G.M.'s workers bought 30 per cent more in 1936 than in 1929.

Commenting on this spread between the wages of G.M. workers and other workers in industry under the head of "The Future of the Wage Level", Mr. Sloan says: "While . . . General Motors believes in high wages, and proposes to do everything possible to maintain a forward position in that respect, the point must be reached when further technological progress can better be capitalized in the interests of all the people in the form of lower selling prices—thus bringing the industry's products within the reach of a greater number, promoting more employment and adding to the creation of national wealth.

"In other words," the statement continues, "it is not healthy to continue widening this difference in wage rates indefinitely. For other workers with lower wage rates are, as a whole, important customers for automobiles, and for the industry to maintain its production and the employment of its facilities there must be maintained a reasonable balance of income between groups of workers so that they can continuously give employment to one another through interchanging goods and services. Automobile wages should show an example, but should not be too far ahead of the average wage level, otherwise the prices of automobiles will get beyond the reach of the great mass of possible customers.

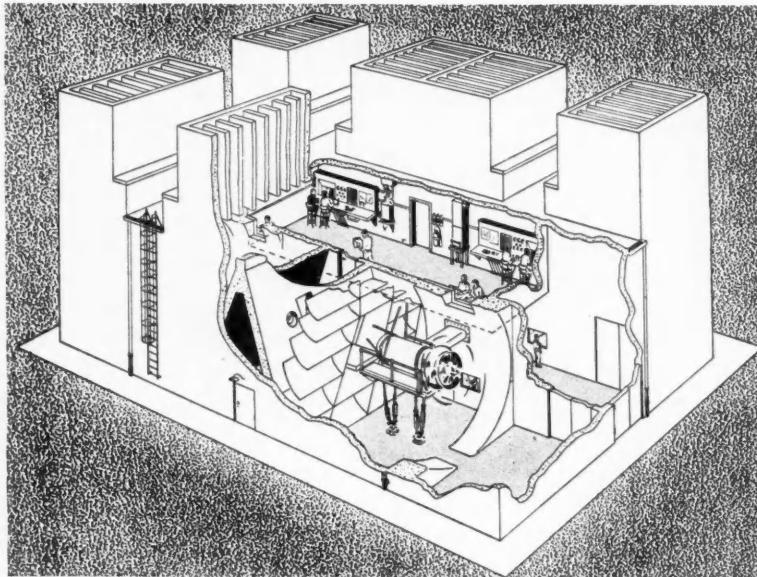
In other words, now, as in the time of Aesop, killing the goose that lays the golden eggs will not increase the national wealth. The automobile industry, of all industries, is particularly sensitive to fluctuations in the upper 25 per cent of the average national wealth of the last ten years.

Motor vehicle prices had to be increased last year at a time when the estimates of national income for the year were being pared. An important factor in increased prices for automobiles was increased labor cost. Anything which can be done to keep automobile prices roughly in conformity with the trend on national income will unquestionably result in increased sales of motor vehicles.

This is a law of much more fundamental importance than a great many of those which have come out of Washington recently, and one that is more unpalatable to organized labor.

It is a law that must be "obeyed" if volume production and mass employment are to continue in the motor-vehicle industry. General Motors is to be commended for a frank foreshadowing of eventual necessities.—H. H.

Test House



Cutaway view of new Pratt & Whitney engine test house

A NEW engine and propeller test house just completed by the Pratt & Whitney Aircraft division of United Aircraft Corporation at East Hartford, Conn., was designed with a view toward the future and can accommodate engines up to 3000 hp. rating, although the largest engines now in production develop only 1500 hp. It has four identical test chambers, each big enough to swing the 23-ft. propellers that will be required to absorb the power of these larger engines. This will make it possible to run tests on engines and propellers simultaneously, with resultant economies.

The new building, whose four test chambers will supplement those of smaller size already in use, is of modernistic outside appearance, resembling a geometric arrangement of building blocks, without outside windows. In its design a great deal of thought was given to the problem of minimizing noise and vibration.

The outside walls are of concrete, 18 in. thick, and the entire structure contains 4600 tons of concrete and 160 tons of reinforcing steel. In addition, a new type of sound-absorbing material known as cali-stone is suspended in the intake and exhaust stacks. While it is impractical to completely eliminate the noise of high-powered engines running under full throttle, tests are said to have shown that the noise emanating from the stacks of the new building when 1500 hp. engines are being tested is substantially below that of the older test houses where smaller engines are being tested. It is believed that as engine horsepower increase further, it will be possible to hold the noise to substantially the same level by increasing the height of the sound-proof stacks.

The four test chambers are grouped around a central control room located on the upper level,

*just completed by
Pratt & Whitney
can accommodate
engines up to 3000
hp. It has four test
chambers each large
enough for the swing
of 23 ft. propellers*

which is equipped with four control desks for the operators. A new double-type of sound-proof window enables the operator to look into the test chamber and observe the operation of the engine during the run. There are always two sound-proofed doors between the engine chamber and the control room, and noise is reduced further by the use of an "acoustical ceiling" suspended below the concrete ceiling, with a fresh-air duct and an exhaust-air duct in between. As a result of these soundproofing measures it is said to be quite possible to carry on conversation in the control room with all four engines running, the noise level being reduced from 135 decibels in the engine chamber (which is even higher than that of a boiler factory) to around 78 decibels at the control desks.

The method of suspending engine mounts by cable, originated by Pratt & Whitney, has been retained, and has been improved upon by crossing some of the cables in the fore-and-aft direction, so they will resist propeller thrust. The ends of the cables are anchored in rubber-crated mountings to provide a flexibility simulating as nearly as possible the conditions encountered in actual flight. The section of each test cham-



View looking up an exhaust stack at the rear of a test chamber

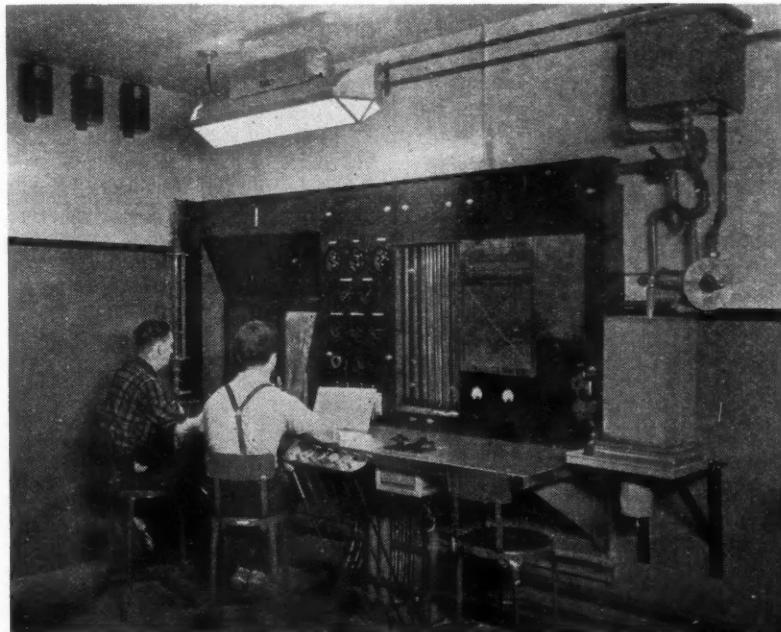
ber in the plane of the propeller has been made circular to permit the operation of large propellers without the usual wall interference encountered when propellers rotate in houses of square section. By lowering two electrically operated heavy canvas curtains the engine test chamber can be cut off from the outside air, and the engine chamber heats up rapidly to a comfortable temperature when installing or removing an engine. A working platform supported from the suspension cables is permanently installed on each stand, and a telescoping portion of this platform can be extended forward and around the engine when it is stopped for adjustments.

The carburetor air is taken in from the roof and led down through large ducts just outside the ends of the control room, and then through air-temperature regulators to the engines. The quantity of air used

by each engine is measured by means of calibrated orifices. Air to the propellers enters the intake stacks at the corners of the building, and after

leaving the engine, passes through a series of heavy steel baffles installed in the entrance to the exhaust stacks to improve cooling-air flow conditions. Whereas in the older test houses the exhaust stacks are placed back to back, with a common wall between them, in the new test house they have sloping walls which form an A-shaped space between the two stacks. Stairways located in these A-shaped spaces connect the control room with the lower floor, and small observation windows in the sloping walls, which are accessible from the stairway, enable an observer to view the exhaust from all engine cylinders.

Provisions are made for the measurement of fuel flow, fuel consumption, rate of oil flow through the engine, and oil consumption. In addition, each stand is provided with 48 thermocouples for measuring the temperature at various points on an engine. Each instrument panel also carries a tachometer, fuel and oil pressure gages, and remote-reading thermometers for the measurement of oil and carburetor-air temperatures. Pressures at various points in the induction system are shown by a group of "U" tubes. The principal item of equipment, of course, is a torque meter.



Close-up of one of the operator's control panels

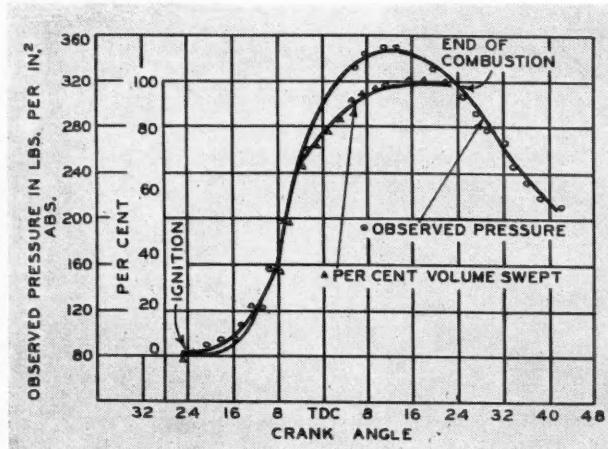


Fig. 1—Observed pressures compared with inflamed volume

Combustion Phenomena . . . Aircraft Engine Accessory Drives . . . Progress in Automotive Manufacturing . . . An Anti-knock Fluid and De-icer . . . and other subjects of primary interest to the automotive engineer are covered in these abstracts of

Combustion Phenomena

FURTHER work in connection with a study of combustion phenomena in engine cylinders was presented by Gerald M. Rassweiler and Lloyd Withrow of General Motors Research Laboratories Division in a paper entitled "High-Speed Motion Pictures of Engine Flames Correlated with Pressure Cards." They had made use of a high-speed motion-picture camera and taken pictures of engine flames at the rate of 5000 frames per second, or about twenty frames of a single explosion, and at the same time had taken accurate records of the pressure variation in the combustion chamber. In analyzing the data thus obtained it was found convenient to express the progress of combustion both in terms of inflamed volume of charge and in terms of the burned fraction of the weight or mass of charge. All tests were made at an engine speed of 900 r.p.m., with a spark advance of 25 deg., the fuel used being iso-octane, the air/fuel ratio 13/1, and the compression ratio 4.6/1. The engine was run with full-open throttle.

Pressure records were made by means of the carbon-stack indicator developed by Martin and Caris, in combination with a Duddell oscillograph. The methods used in establishing the pressure and time scales are described in detail in the paper.

In determining the per cent of the combustion space swept by flame at any given time, use was made of plaster casts representing the clearance volume plus the displaced volume for the particular crank angle. The flame picture was projected on the upper face of the particular cast,

the position of the forward edge of the flame front was marked on the cast, the cast was cut along this line, and the two portions were weighed. Errors inherent in this method were discussed at length.

In Fig. 1 the original data obtained from flame pictures and the pressure record of an explosion are compared graphically. The observed pressure and the per cent volume swept by flame are plotted against crank angle on separate ordinate scales which are so arranged that the two curves coincide at the beginning and end of combustion. It will be seen, however, that the curves follow quite different courses over a considerable portion of their lengths. It is thus apparent that the progress of combustion cannot be deduced quantitatively in terms of per cent volume inflamed by visual inspection of the pressure-time records.

Owing to differences in the densities of the inflamed and non-inflamed charge at any given time, the fractional volume of charge inflamed is not equal numerically to the fractional mass of charge inflamed. As the pressure developed in the combustion chamber depends on the heat liberated, and therefore on the weight of charge burned, the lack of coincidence between the two curves in Fig. 1 would be expected.

Two different methods were developed in the paper for calculating the per cent mass burned in any given flame picture (which corresponds to a given crank angle and a given combustion-chamber pressure related to the end of exposure of that particular frame). In Fig. 2 the per cent of mass burned is plotted

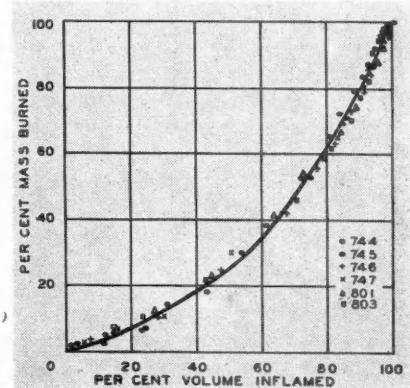


Fig. 2—The relation between volume swept and mass burned

against the per cent of volume inflamed. It is apparent from this that when the flame has swept through 25 per cent of the volume of the combustion chamber, only about 10 per cent of the mass has been burned. When 50 per cent of the combustion chamber is filled with flame, only about 25 per cent of the mass has been burned. Again, when 75 per cent of the volume is inflamed, one-half of the original mixture by weight is still to be burned, and this is burned during the time the last 25 per cent of volume is inflamed.

The next step in the analysis consisted in determining the relationship between the percentage of the charge burned and the pressure developed in the cylinder. On account of the comparatively small piston motion during the combustion period, the combustion is frequently assumed to take place at constant volume. If this assumption were permissible, much of the thermodynamic treatment of constant-volume bomb explosions could be applied directly to engine combustion. In constant-volume bomb explosions the

SAE Detroit Papers

fractional mass of charge burned at any instant is taken to be practically equal to the fractional pressure rise, and if this were applicable to engine combustion, the pressure-time curve should be of the same shape as the mass-burned curve.

A direct comparison of the per cent mass burned and engine pressure is made in Fig. 3. Both curves have been so arranged as to coincide approximately at the beginning and end of combustion. However, the shape of the mass-burned curve differs considerably from the observed-pressure curve. The most obvious difference in the shapes of these curves is to be seen between top dead center and the end of combustion. It will be noted that the pressure

reached a maximum about 12 deg. of crankshaft revolution before flame propagation was completed, and this observation furnishes a clue to the reason for the difference between the two curves.

During the interval between top dead center and the end of combustion, the effect of piston motion tending to decrease the pressure is greater than the effect of combustion tending to increase the pressure. The considerable effect of such small piston motions during the combustion process results from the obvious fact that as the pressure level is increased, the pressure change produced by a given change in total combustion-chamber volume also increases.

R. P. Lansing of Eclipse Aviation Corp. divided these accessories into two groups, Group 1 including all accessories intimately connected with the functioning of the engine itself, and Group 2 other accessories. Group 1 includes two magnetos, a fuel pump, starter, lubricating-oil pump, scavenger oil pump, propeller-governor, supercharger regulator, tachometer and machine gun synchronizer. Group 2 includes a generator (either A.C. or D.C.) for lights, starting, radio, cooking, heating, etc.; an A.C. generator for operating remote-reading instruments, an automatic pilot pump, a de-icer compressor, a fuel transfer pump, an instrument vacuum pump, and a hydraulic power oil pump.

Accessories of the first group must be located on the engine and duplicated for each engine. These accessories should be as close as possible to the center of gravity of the engine to protect them against whip due to flexible engine mountings. For the second group of accessories an indirect drive by means of a hydraulic or electric motor has been suggested, the power being supplied by a pump or generator driven from either the main engines or an auxiliary engine. An alternate method would be to mount all of these accessories on a separate accessory-drive unit or gear-box. This gearbox might be driven in any one of a number of ways, viz., through (1) a flexible shaft of 30-hp. capacity from the main engine; (2) a hydraulic motor driven by a large hydraulic pump on the engine; (3) an exhaust-driven turbine; (4) an electric motor driven by large generator on the engine, and (5) an auxiliary gasoline engine.

The 20-hp. gearbox would consist of a main section and an auxiliary section with provisions for driving the main section alone should only a few drives be required. Each section would ordinarily handle four accessory drives, and the main section would handle a complete lubricating system which would supply not only the gearbox but all the accessories mounted thereon. The main section would carry three 5-hp. accessory drives and one 2.5-hp. accessory drive, and all, with the exception of one, would normally operate at 3000

Aircraft Engine Accessory Drives

WITH constant additions to the number of airplane accessories that require a drive, the problem of accessories

drives on aircraft engines is becoming increasingly difficult. In a paper entitled "Analysis of the Accessory-Drive System of Aircraft Engines,"

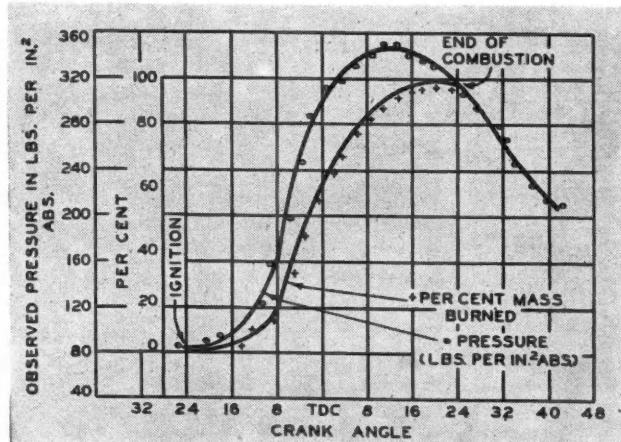


Fig. 3 — Observed pressure compared with per cent mass burned

r.p.m. The exception, a 5-hp. drive, would operate at about 2000 r.p.m. The weight of the gearbox would be limited to 40 lb. There should be a friction clutch in its drive by flexible shaft, and this clutch and the lubricating system are included in the 40-lb. weight limit.

A large amount of the energy of combustion is lost in the exhaust, and if sufficient of it can be recovered without the use of apparatus of excessive weight, an exhaust-driven turbine might be used to drive the gearbox.

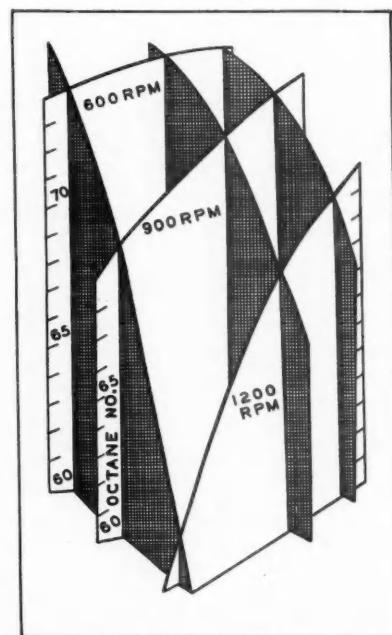
A large generator mounted on the main engine and supplying current to a motor on the gearbox would have many desirable features, such as constant-speed drive of the gearbox, ease of connections, freedom of location, and great flexibility of control. Its most serious drawbacks appear to be excess space requirements and weight on the engine, and rather low efficiency. To save weight in the motor and generator, they would be designed for high-speed operation. In the case of the motor the incorporation of a suitable reduction gear in the gearbox would permit of this high operating speed, but weight and space limitations about the engine would hardly permit gearing up the generator.

All methods of gearbox drive so far considered do not permit ground operation of the gearbox and its accessories with the main engine either throttled or at rest. This is very desirable for the operation of radio, cabin lighting and heating, fuel transfer, refueling, and many military functions. This consideration counts heavily in favor of an auxiliary powerplant of the gasoline-engine type. Our own Navy has used

such auxiliary powerplants for many years. A French concern is offering a 10-hp. auxiliary powerplant that, besides driving a fairly large generator, drives oil and fuel pumps, an air compressor, etc.

More than one new military and naval planes have been fitted with auxiliary power systems, but nothing can be said about these. Some of the operating companies are cooperating in the development of a super transport which will have two four-cylinder auxiliary engines of about 20 hp. each for driving the gearbox. A double-opposed, Prestone-cooled engine was selected as the best compromise between over-all length and balance. The engine, which operates continuously at 4000 r.p.m., was purposely made oversize so that it will develop the necessary power at altitudes without supercharging. Space restriction is due to the fact that the engine is located directly behind the fire wall in the inboard engine nacelles. The rating is 22 hp., though at sea level the engine will develop approximately 30 hp. Aviation practice was followed in the design.

In the interest of dependability, dual magneto ignition was specified. Crankcase and gearbox are practically integral, and provision is made for seven accessory drives ranging in speed from 2000 to 4000 r.p.m. Because of the location of the engine, all functions concerned with its operation are required to be fully automatic, including starting and the control of spark advance, carburetor heat supply, mixture, choke and low-speed operation during the warm-up period. Speed of the engine is controlled by a sensitive hydraulic governor.



Effect of engine speed and mixture temperature on anti-knock rating of fuel at 17 deg. spark advance.

given in the form of three-dimensional charts, of which a sample is reproduced herewith. This particular chart is for one particular fuel (referred to by a symbol in the report) and for a spark advance of 17 deg. The vertical scale is in octane numbers and the two scales in the horizontal plane are of speed of test engine and mixture temperature. Such three-dimensional charts were given for four different fuels.

(Turn to page 158, please)

Safety Via Science

(Continued from page 137)

another auto was approaching an intersection from a different direction.

Developments in the radio and electric fields have been so rapid, according to Dr. McClintock, that mechanisms once thought visionary are now within practical reach.

"Conquering the menace of the 'hazard zone'—where skidding throws the car out of control—will be science's major triumph," said Professor Lessels.

"In the hazard zone of motoring, physical and mechanical forces beyond your control take over the wheel, the brakes, the speed, and even the directions of the car you are driving," he said.

"Science has already solved many problems that appear to be just as difficult. In this case, I anticipate that some way will soon be found to give us, in effect, a battery of windshield wipers under the car, to remove the danger of the hazard zone."

Laboratory Test Procedure

A REPORT of the Laboratory Procedure Group of the Motor Fuels Section of the Cooperative Fuels Research Committee was made by Dr. A. E. Becker of Standard Oil Development Co. This group has been doing research work with a view to developing test conditions that would (1) give ratings between those of the motor and research methods, (2) be more severe than the motor method, and (3) be as mild as or, if possible, less severe than the research method. The work covered a study of the following:

1. Standardization of knock intensity for the various conditions of test. To facilitate comparison of results, it was decided to make all

tests at a knock-intensity level comparable to that of the motor method.

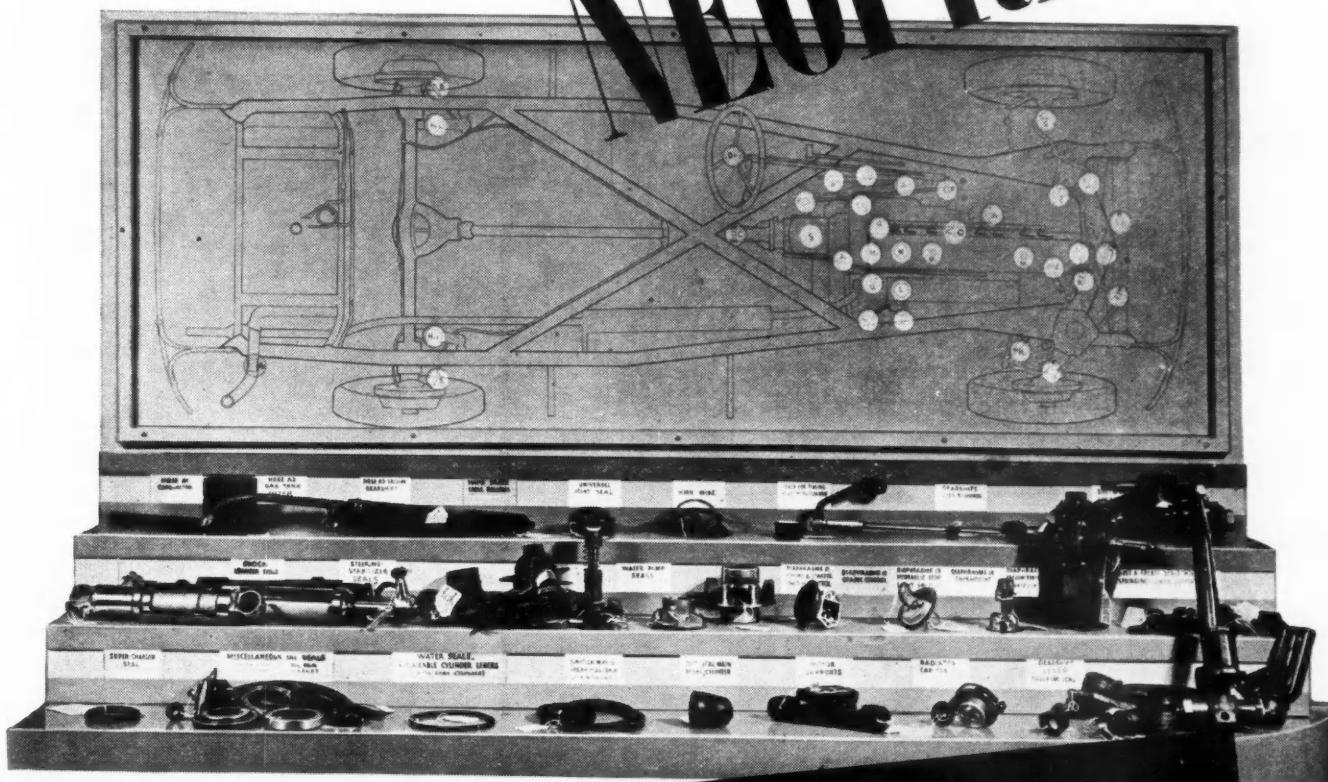
2. The relationship between spark advance and power, and between spark advance and knock, throughout the compression-ratio range used in making octane ratings. This was done at several speeds and two mixture temperatures.

3. The effect of the following variables on the ratings of a selected list of the W (winter) fuels:

- a. Speed—600, 900 and 1200 r.p.m.
- b. Mixture temperature—300, 200, and 150 deg. Fahr.
- c. Constant spark advance—26, 17, and 10 deg.

Some of the results obtained were

The answer was **NEOPRENE**



**AUTOMOTIVE DESIGNERS SOLVE
40 BAFFLING PROBLEMS BY EMPLOYING
UNUSUAL PROPERTIES OF CHLOROPRENE RUBBER**

PICTURED ABOVE is a portion of the neoprene exhibit at the S. A. E. Engineering Display held recently in Detroit. Over 40 applications of neoprene were shown...and these were only a portion of the applications of neoprene in 1938 automobiles.

We predict that next year's models will have



even more parts made of neoprene, for automotive engineers have discovered that neoprene is amazingly stable under severe service conditions. They know that compounds made of it resist the deteriorating effect of oils, heat, gasoline, oxygen, ozone and chemicals—that neoprene endures where other materials fail.

NEOPRENE

*can help you with
your problem*

**ASK YOUR
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E. I. DUPONT DE NEMOURS & CO., INC., RUBBER CHEMICALS DIVISION, WILMINGTON, DEL.

each tested with three different spark settings. The report was a progress report and no definite conclusions were drawn.

Piston Ring Wear

MACY O. TEETOR of the Perfect Circle Co. gave a "movie talk" on "The Reduction of Wear of Piston Rings and Cylinders." He said the development work on piston rings illustrated by the film covered a period of about six years.

It was found that scuffing and wear were closely related to the grain structure of the cast iron. If the structure was such that in the event of metallic contact between ring and cylinder wall large grains or crystals broke out, these would get between the ring and the cylinder wall and would cause scoring and scuffing. On the other hand, if the particles that were detached were very fine, they had a polishing effect and made both the ring and cylinder wall more resistant to wear.

From this point of view, therefore, it was desirable that a ring

material be produced which, when subject to abrasive effects, would break up into a very fine dust. Unfortunately such materials do not have the elastic properties required of piston ring material, and the idea, therefore, occurred to them to subject the rings to a surface treatment which would change the grain structure of the wearing surface in such a way that any particles that might become detached in service would be of very small size and have a polishing rather than a scoring effect. whereas the structure of the metal underneath would not be affected. The surface layer produced on the ring by this process is known as Ferrox.



No doubt about it, improving the balance of rotating parts in an automobile improves comfort. But how can improvements be made in parts or units believed to be commercially perfect, such as Mechanics Universal Joints and Shaft Assemblies? It has not been easy, but it has been done! Mechanics has developed a new slip joint design which reduces weight substantially, facilitates maintenance of accurate alignment, and moves center of mass closer to point of support. The result is improved balance . . . which improves riding comfort. In addition, the new slip joint has other features of design and construction which provide new

smoothness of operation and long life. Already standard equipment on notably successful cars, Mechanics Shaft Assemblies with the new slip joint deserve careful consideration by all executives concerned with building better automobiles. Investigate.

MECHANICS UNIVERSAL JOINT DIVISION
Borg-Warner Corp. 1301 18th AVE., ROCKFORD, ILLINOIS

in the desert. Every taxicab must be repainted, its identity camouflaged by the painting in of a "fake" name and a "fake" telephone number. That's because a taxi company, back in the "dark ages" of movieland, collected damages from a producer who used an uncamouflaged cab in a picture in which the taxi driver was the villain. A jury held the taxi company to have been "injured." All such special paint jobs are done in water-colors, which are easily removed, because every car must be returned to its owner in just the condition in which it was delivered to the studio.

The only times when the finished surface of a car is treated by Universal Pictures is when hiliation is likely to occur. As a chrome plate oftentimes reflects light, the studio applies masquing tape, which is black, to eliminate reflections. At least 90 per cent of the cars used by Universal for shooting are open vehicles. If the scene requires a closed car and is to be photographed inside, it is necessary to remove the top and one side in order to focus the proper light rays; in such a case a special body is built.

For films showing a foreign *locale* the studio is enabled to rent foreign cars in downtown Los Angeles. Foreign cars are employed in about only 1 per cent of Universal's pictures of American *mise-en-scene*. The company has no tie-up with any motor manufacturer or distributor, but it uses Graham-Paiges more than any other make, its transportation chief reports, "on account of their snappy style."

A most important consideration, regardless of the antiquity of a vehicle pictured in a film, is that it must be mechanically perfect. Breakdowns by automobiles can cause delays just as costly as the illness of a star.

The cars and trucks wrecked in the "movies" are not always old dilapidated machines ready for the junk pile. In the majority of instances, of course, this mechanical prototype of the bull-fighting horse, known in studio jargon, like the other, as a "jalopy," is exactly that. It is stripped of motor, speedometer, horn, batteries and everything that can be salvaged without altering the exterior appearance of the vehicle. But often it is a relatively new car that goes hurtling over the precipice or off the bridge. This economic waste is usually due to the fact that the studio has found it impossible to match the wrecked machine for the always possible contingency of "retakes" without buying two new cars.

GM's New Diesels

(Continued from page 148)

increases in depth toward the rim, in conformity with the shape of the spray cones. There are cooling ribs on the underside of the piston head, and a nozzle screwed into the top of the connecting rod and communicating with the oil hole through the connecting-rod shank, throws a jet of oil against the under side of the head, which carries off a large part of the heat absorbed by the piston

from the burning gases. The piston bosses are supported not only by the piston walls but more directly by lugs extending down from the piston head. It is interesting to note that a "heat dam" is provided above the ring belt, where the wall thickness is reduced to less than the radial depth of the piston rings, to keep down the temperature attained by the piston rings and thus prevent ring sticking. The great width of the top land no doubt also helps to keep down the temperature attained by the top ring. There are four compression rings on the piston above

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Men at work..oil dermatitis prevented..compensation payments saved. That's the story wherever Derma-San is used. One pint of Derma-San added to 35 gallons of cutting lubricants kills dangerous pus-forming germs—before they attack workmen. Stop paying for laid-up workers and higher insurance rates. Join the crusade against oil dermatitis today.

The HUNTINGTON LABORATORIES Inc.

DENVER HUNTINGTON, INDIANA TORONTO

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DISINFECTANT

the piston pin, and two scraper rings at the lower end.

The crankshaft has main bearings of $3\frac{1}{2}$ in. diameter in all models of the 71 series, and all main bearings are of the same length, viz., $1\frac{1}{8}$ in. There are four main bearings in the three-cylinder model, five in the four-cylinder model, and seven in the six-cylinder model. Crankpins have a diameter of $2\frac{3}{4}$ in., and the crankpin bearing is $1\frac{25}{32}$ in. long. All bearing bushings in all models are thus alike and interchangeable. This feature of interchangeability applies also to the piston, valve gear, con-

necting rod, pump, timing gears, flywheel housing and like parts, which are all interchangeable between the different models.

A new design feature is the provision made for balancing the three-cylinder engine. With a three-throw, 120-deg. crankshaft there is a small fore-and-aft rocking couple due to inertia of reciprocating parts. This rocking couple is completely balanced by an equivalent opposite rocking couple produced by small counterweights mounted on opposite ends of the camshaft and a second similar shaft on the opposite side of the

cylinder block. Both of these shafts, of course, rotate at crankshaft speed and in opposite directions. This device makes it possible to produce engines of one, two, three, four, five, six and more cylinders that are free from unbalanced forces and couples. This balancing system and the inherent symmetry of the two-cycle uniflow type of cylinder makes possible an entirely new approach to the problem of a line of engines covering a range of power requirements, with various accessory arrangements and different directions of rotation.

A most interesting feature is that the entire cylinder block and blower assembly can be turned end for end without disturbing the flywheel or gear train, and thus place all accessories on the opposite side. In a similar manner the cylinder head can be reversed regardless of the position of the blower, to place the exhaust and water manifolds on either the same or the opposite side as the blower. By shifting one gear in the gear train and changing the camshaft and oil-pump cover, the rotation of the camshaft can be made either clockwise or counter-clockwise with any of the above accessory arrangements. The generator and air compressor, or vacuum pump, can be mounted over the gear housing and driven direct from the cam and balance-shafts, or secured to the side of the crankcase and belt-driven. Fuel injectors are identical for all models. All of these assemblies can be made with a few right- and left-hand parts, the result being eight distinct models of each engine size.

It is obvious that the similarity of parts and the reduction in the number of different kinds of parts has had a marked effect on the machine and tool set-up in production. Many of the machines and fixtures take the parts for all models. This permits volume production methods to be applied where the number of models would otherwise make the tooling cost prohibitive.

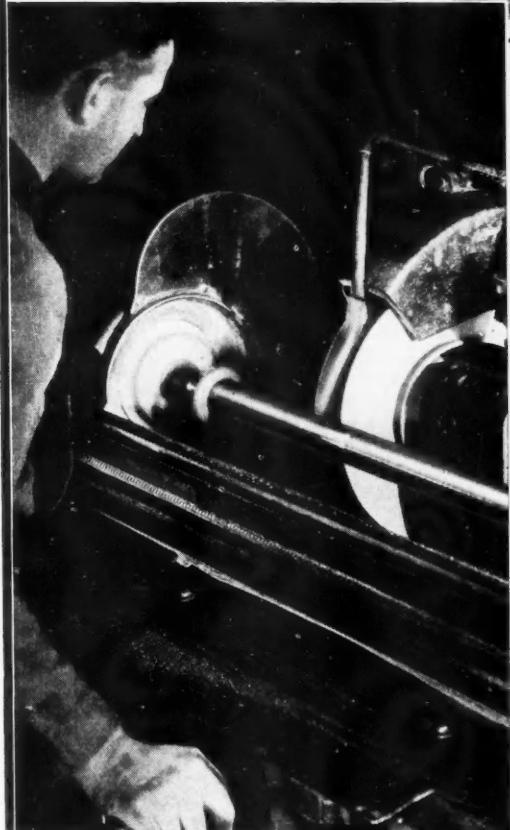
The adaptability of these powerplants to a great variety of uses is also an outstanding feature; such as right- and left-hand twin-screw marine installations, left-hand engines for rear-engined coaches with the accessories all on the open side, right- or left-hand drive trucks, marine engines with the gearbox on the front end of the engine, Diesel-electric generator sets, etc. From the operator's standpoint the chief advantage of this unification is undoubtedly simplification of the service problem.



The years of research and experience by the originators of the Sylphon Bellows—the pioneers and leaders in its application to temperature control—are reflected in the high standards of quality and dependability of Sylphon Automotive Thermostats. That is why they are preferred by leading automobile manufacturers, constantly striving for further improvement in motor efficiency and fuel economy.

THE FULTON SYLPHON CO., KNOXVILLE, TENN.

CYLINDRICAL GRINDING WHEELS



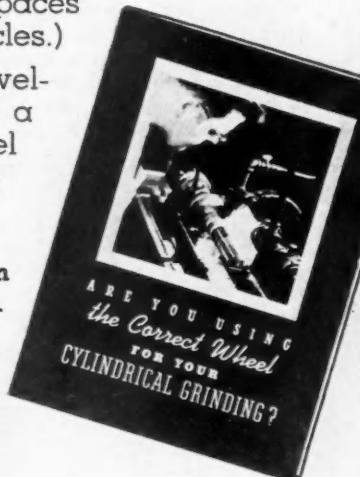
These representative features of Bay State's scientific methods of manufacture are giving proven, profitable, production on all types of cylindrical grinding operations.

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